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TABLE OF LEADING ARTICLES.

Ourselves As Others See Us 145
Relief for the Suffering Public 145
Central Stations for Heating and Power 146
Lump Sum and Unit Price Contracts..... 146
A New Form of Filter Gallery at Nancy, France. (Illustrated.) 148
An Electrically-Driven Flour Mill 149
The Steam Turbo-Generator Station of the Edison Electric Illuminating Co., of Boston. (Illustrated) 150
The Pasadena, Cal., Sewer Farm..... 154
An Improved Detail for Lateral Connections. (Illustrated) 156
The Extension of Riverside Drive, New York. (Illustrated) 157
The Moline Bridge. (Illustrated) 158
The Mechanical Plant of Simmons College, Boston. (Illustrated) 160
Mechanical Plant of a Power Building in Providence, R. I. (Illustrated) 162
Losses in Electric Power Transmission..... 164
Extent of Infiltration through Perforations in Manhole Covers. (Illustrated)..... 164
Construction of Foundations for the Yonkers Power House of the New York Central Railroad. (Illustrated) 165
Traffic Sustained by Asphalt and Granite Block Pavements on Prominent New York Streets.... 166
Practical Work of Constructing Sidewalks..... 166
A Study for a Central Power and Heating Plant at Washington. 167
Fire Tests of Automatic Sprinklers 170
Tests of Reinforced Concrete Beams 170
A Regulating Valve for Double Reservoir Service. (Illustrated) 171
Stiffened Suspension Bridges. (Illustrated)..... 171

Ourselves as Others See Us.

The various engineering congresses of last year are now bringing forth fruit which cannot be otherwise than pleasing to the American palate, as a rule. Last summer's visitors to this country from abroad are now discussing our technical and industrial methods very frankly, and it is interesting to learn from them how American engineering and manufacturing systems appear to the men who have won success in a similar field in other countries. For example, at the last meeting of the Institution of Mechanical Engineers, four papers giving the results of observations made in the United States were read and discussed. One of these may be briefly reviewed here.

In one of these papers Mr. A. J. Gimson gave his general impressions of sixteen shops, making engines, pumps, machine tools, transmission machinery, elevators and valves. Some were old works manufacturing a wide variety of products, and others were new plants turning out a few specialties. With possibly one exception, the best of these shops could be matched in Great Britain, Mr. Gimson thought, so far as equipment and general methods of carrying out work were concerned. Some of the shops he considered no better than the British average. But in organization he frankly gave precedence to the American plants. He was much impressed by the close relations of technical institutes and shops, of professors and manufacturers, and the presence in minor positions of authority of young men who had received a complete course of technical instruction. Methods were observed for obtaining accurate machine work and testing the accuracy of machines while being assembled "which were admirable in their approach towards perfection."

A particularly interesting feature of the organization was the close study of economy by the drafting and office staff. In one shop every separate job for every machine was ordered from the office, where every detail in the process of manufacture was settled and the time allowed for each process was fixed. Such an organization utilized the full time of each man to the best advantage. No foreman did clerk's work. The machinist attended to his machine tools, and his chucks, gauges and tools were kept in condition and brought to him by other men. Mr. Gimson considered that this organization to secure the maximum returns from wages was the finest feature of American workshop practice. "Persistent energy and patience have achieved remarkable results in the organization of cheap production in some of these workshops."

This view was endorsed in the discussion by Mr. Mark H. Robinson, who said that the superiority of American shops was due to their better organization. Mr. Stanley Bott would not admit that American workmen were in any way superior to British, but he acknowledged that their skill and ability were used to better advantage. The shops he visited in America were better arranged and organized than most of those in Great Britain, where the managers did not look after the details as they did in America, nor kept such accurate analyses of cost of production. Mr. Bott was particularly enthusiastic over the results obtained in some American shops with the card index system.

These opinions are flattering to the United States, but others were expressed that were not so favorable. Mr. Charles Wicksteed, for example, while acknowledging the importance of our shop organization, did not believe American machinery was any better as a whole than that made in Great Britain or that the American workshops built at the same date were any better than those in Great Britain. He found that some of the famous show factories of the United States were paying very small dividends and some none at all, and he did not consider such shops were rightly rated as successful. The new American shops should not be compared with the old cramped structures, with their obsolete machinery, that are struggling along in Birmingham and Leeds, but should be contrasted with the modern establishments like those at Rugby and other new manufacturing centers. The leading criticism to be made of the best shops of the two countries was, in his opinion, that in Great Britain there was too little method and in the United States too much.

Such remarks are very interesting to anyone who has observed the marked change that has come over American manufacturing methods in the last twenty-five years. At the time of the Centennial Exposition in Philadelphia, the Yankee mechanic still exerted a great influence. He was the product of harsh conditions, the descendant of earnest men of the English middle class who settled in a part of the country having few natural advantages. A successful existence in the early colonial days called for ingenuity, boldness and diligence. The mechanics trained in such a school naturally developed into ideal men for small general shops. As shops grew in size, however, the need for such men has not grown at an equal rate. It has been possible in the large works making standard products to introduce semi-automatic machinery run by less resourceful men than the old-time Yankee machinist. In many American shops to-day a very large proportion of the men are of foreign birth and training, yet by the improved organization under which they work they are probably accomplishing more than they would elsewhere. It is the shop manager instead of the mechanic who has produced the high standard of American industrial establishments. Political oratory may continue to praise with glittering effusiveness the resourcefulness of the American mechanic, but it is the brilliant manager who has brought about the great organizations that are both successful and large. The old-fashioned general machinist has little opportunity to show to the best advantage in these shops, although he is occupying a respected and responsible place in the many small works which are still the backbone of American industrial life.

Relief for the Suffering Public.

In the prosecution of municipal works and the undertakings of private corporations which involve the occupation of streets, it is frequently necessary to obstruct travel, store materials on the surface and sometimes to damage adjoining property. Something of this nature must inevitably occur, and no matter how trivial the injury may be, the party who suffers magnifies it. If he has friends in journalism they spread the tale of his misfortune, and presently he begins to think that he is really the victim of official negligence and contractors' avarice. The other side of the story is equally unsatisfactory to contemplate; the contractors have based their estimates on the use of the streets in all ways permitted by the terms of their contract obligations, but when they attempt to take advantage of what they consider their rights they are met at every turn by the opposition of private parties and public officials. The result of all this is that in many cities the property owners begin to cry from mere habit whenever they see a tool cart in their vicinity, while contractors have become so accustomed to unreasonable opposition that all complaints look alike to them.

This unsatisfactory condition is by no means necessary to the extent to which it has developed. The people living or doing business along a street have a right to the use of that street if it can be given them by any reasonable precautions. The continuous storage of materials in front of their homes or stores and the upheaval of the street for months at a time are not excusable. At one time it was held that a great subway could not be built below a city street without closing it, but any such claim has been definitely disproved by the success of the work done by the Boston Transit Commission. The construction carried on in the streets of Boston under the direction of that commission has never been equaled anywhere in this country for its freedom from obstruction to traffic.

On the other hand, it must be understood that the contractor has rights. When he figures the cost of carrying on work in a city he must estimate on the cheapest way it can be done and still build a structure complying with the conditions. Any requirements which will make it necessary for him to keep streets and sidewalks without any obstruction during a part of the twenty-four hours will affect the cost of the work, and must be stated in the specifications. Under the usual contract and specifications for water-works construction, the contractor is perfectly justified in taking cast-iron pipe from the cars as they reach the city and delivering it along the streets where it will be laid; if he does not do so he must pay demurrage on the cars and thus raise the cost of the work to himself. It is true that the pipe will be an obstruction while lying on the streets or sidewalks, but he has the right to put it there. Trench work is oftentimes materially cheapened if no regard is paid to the use of the street in which it is executed, and the same is true of pavement work.

These conditions deserve a great deal more attention than they have received in most American cities. Neglect of them has brought unwarranted injury to property owners and has made the work of the contractor needlessly unpleasant. On a close analysis it will be evident that the trouble is due to the lack of suitable definition in the contract and specifications of the obligations of the contractor in the way of keeping streets and sidewalks clear. The Boston Transit Commission made very clear and precise regulations of this nature and required contractors to live up to them. It assumed the responsibility for saying what the contractor might and might not do, and thus solved the problem in the way it has long been settled in Europe, where nobody would think of such tremendous upheavals of street surfaces as Americans have come to regard as a matter of course. It is true that our work is often done at a lower cost than abroad, but it is accomplished at a sacrifice of private rights which would be regarded as intolerable in some foreign cities.

The time is at hand when Americans will refuse to permit the needless obstruction of traffic and will demand that the city officials responsible for public work shall require contractors to be more careful of private interests. This will make the work cost more, it is true, but the extra cost is warranted by the public convenience. The condition of streets in which sewer and water pipes are being laid is often disgraceful and should be prevented by the same kind of legal obligations that are in force abroad.

Central Stations for Heating and Power.

One of the most interesting investigations made for some time was completed a short time ago by Mr. Bernard R. Green, superintendent of the Library of Congress, with the assistance of Prof. S. Homer Woodbridge, for the purpose of determining the advisability of erecting a central station for the group of present and prospective Federal executive buildings in the vicinity of the Mall in Washington. The interest in this report, sections of which are reprinted in a condensed form elsewhere in this issue, lies principally in the statements regarding the proposed heating facilities afforded by such a plant. It is too well known that a central station is the logical solution of the lighting problem for such buildings as these to make it worth while discussing the portion of the report relating to this subject, although it might be said in this connection that remarkably fine results are being regularly obtained now with gas and gasoline engine plants which threaten to make necessary some revision of the general figures of the cost of running independent lighting plants for buildings of moderate size.

The heating of a considerable number of detached office buildings from a central station is, however, a rare problem, at least in the form in which it is presented in Washington. Of course such heating has been done in many cities in connection with electric lighting, and is being done in New York independently of any other class of service. It is generally believed, however, that such heating is not advisable, and that the central station cannot furnish heat to detached buildings at a cost as low as that of independent plants in each building. One of the most complete investigations of this character ever made was by Prof. James E. Denton for the Narragansett Electric Lighting Co., of Providence, which was reviewed in this journal on Aug. 19, 1899. He reached the conclusion that the company would have to charge forty per cent. more for heating service, in order to make a profit, than it cost to warm the buildings by the apparatus then used in them. This view of the matter was widely quoted at the time, and undoubtedly did much to make central station heating projects rather unpopular.

The proposition presented to Messrs. Green and Woodbridge was not a commercial one, however, although it had to be settled on the basis of financial as well as other considerations. The interesting fact is that they report strongly in favor of the economy of central heating as well as lighting, and estimate that a saving of something like fourteen per cent. over the present charges can be made by adopting such a plan. In addition their plan is unusual because of the recommendation to employ hot-water heating almost exclusively. This is not the place in which to enter into a detailed discussion of such a decision or of their equally unusual recommendation to lay the heating pipes in trenches rather than tunnels. If these suggestions came from engineers of less experience and standing than Messrs. Green and Woodbridge, they would probably be rejected by many readers without the consideration they deserve. Fortunately the sums involved in the project are so large and the importance of the buildings to be heated is so great, that the advocates of the two systems of heating, hot water and steam, may be expected to make a test case of this work. In the report under consideration the argument in favor of the hot water system is stated at great detail, and it is not at all unlikely that engineers who have not kept in touch with the work done in heating detached buildings by hot water will find the argument somewhat surprising.

As a matter of fact, it is not at all improbable that heating by means of the forced circulation of hot water has been looked upon with unmerited disfavor in this country by many engineers, as being a sort of monopoly. The public was not in possession of the experimental data necessary for checking plans of proposed hot-water plants of this type, and the company which has proved the value of this system of heating in the face of heavy opposition is naturally not going about distributing important data to those who compete with it. The results secured with this system of heating have been given out from time to time, however, by well-satisfied users of such plants, and the growing tendency to consider hot water systems with forced circulation of the water as rivals of hot blast systems for warming industrial establishments is a marked feature of mill architectural practice just now.

It is to be hoped, from an engineering point of view, that the plans outlined in the report will be carried out, because it will be possible to secure from the records of the central station plant a mass of data of the highest value. A plant of this character designed by Messrs. Green and Woodbridge and operated with the skill which has marked the management of the building and grounds of the Congressional Library, will become a source of information of much value to engineers on a subject which is still wrapped in so much trade secrecy that it suffers in consequence.

Lump Sum and Unit Price Contracts.

The controversy in Albany regarding the merits of lump sum and unit price contracts has been settled temporarily by the selection of the latter for the first two contracts let for the improvement of the New York State canals. This choice is unquestionably satisfactory to the majority of the engineers engaged on the work and probably to the majority of the contractors who submitted bids for it. In any kind of public work it is desirable to have a clear understanding of the extent and character of each kind of work to be done, and of the rates of payment for each. Not only must the contractor be given an opportunity of proving in a court that he has done certain classes of work for which he is entitled under his contract to receive payment at stipulated rates, but he must also be safeguarded against loss when the quantities of each class of work originally estimated by the engineer are changed by developments subsequent to the beginning of construction. In many undertakings it is entirely impossible to foresee important conditions which will make it necessary to change the amounts of certain classes of excavation, embankment and masonry from those which seemed desirable at the time the plans were drawn. Foundations may develop unexpected difficulties and a redesign of structures may be necessary in consequence. All these things can be much more readily provided for in a contract on a unit price basis than on one for a lump sum. When a lump bid is made it necessarily implies that the work will be executed exactly as specified; unless so executed all sorts of claims for extras can be made, even when the contract contains clauses to the effect that the contractor agrees to accept all modifications of the plans which the engineer considers necessary. If any changes are made involving considerable additional expense to the contractor, the latter generally has little trouble in getting additional payments if he takes the matter to an equity court.

A frequent objection raised to the method of securing bids on the unit price basis is that the engineer does not know what the work really costs and is sometimes led to make classifications and to employ materials which yield a great profit to the contractor without any corresponding benefit to the engineer's client. This argument is frequently advanced, and yet it seems to be entirely without any reasonable basis, for the engineer who is unable to estimate the cost of different items of work is manifestly unable to arrive with certainty at the cost of a completed undertaking except by some occult black art. Under a good system of inspection the engineer in charge of a large piece of construction ought to know about as well as the contractor what it is actually costing the latter. In fact, if his inspectors do not furnish him all the information from which such costs can be figured, something is wrong with that part of his organization. The only part of the cost estimate which the engineer is likely to misjudge is that of reasonable profit, and it is on account of the neglect of the average engi-

neer to recognize that a contractor expects and deserves to make money as a result of his labor and expenditures that there is trouble in preparing suitable estimates.

This situation can only be met by the plan adopted in the city of Toronto and on at least one large railway. The engineer puts in a bid on each piece of work, and if his bid is the lowest the city or the railway, as the case may be, undertakes the construction by its own force. In the case of Toronto the contracts carried out by the city engineer in this manner have shown each year a fair balance on the profit side. In this way the engineer is enabled to know by the actual management of construction just what all the items actually cost, and it is certainly true that he also is taught by experience to appreciate some of the troubles the contractor must carry. In addition the contractors bidding on the work do so with a fair degree of assurance that nobody can gain any advantage by secret combinations or deals.

This last assurance is really the most important thing to be gained by the system mentioned. If it is possible to make a profitable combination on a proposed work there is a natural tendency to do so, and some people have become experts in arranging the bids of different parties so that they appear to be competitive, although very far from it in truth. If the engineer of a city or a railway is always able to undertake the construction in case the bids are too high, it stands to reason that the contractors will actually compete.

There are certain classes of work on which lump sum bids are desirable, particularly on work for private companies which have a reputation for absolute justness and are able to reject tenders from paries not acceptable to them in every way. On public work, however, no matter what its character may be, there is little to be said for such bids, for it is generally necessary to award the contract to the lowest bidder irrespective of his responsibility and experience. The unit price system enables the engineer to keep a much better control of the work, which is essential for promptness when the contractor is inclined to be remiss.

Notes and Comments.

THE RATING OF STREET LIGHTS was discussed at the recent meeting of the Northwestern Electrical Association, by Prof. George D. Shepardson. It would seem, he said, that the most rational basis for a contract for street lighting would be an illumination of the street surface which should have certain average values on main streets, certain lower averages on others, and whose minimum values should not fall below certain specified values. To avoid uncertainties in measuring, care should be taken to specify whether the illumination is to be measured on the horizontal or vertical plane, the latter favoring widely scattered light sources such as arc lights. One of the most satisfactory methods, in his opinion, would be to have recording wattmeters at the power houses so as to measure the entire energy delivered to the street circuits. The main objection to contracting for street lights on the basis of energy consumption is that there is no definite relation between kilowatts and candle-power.

UNDERWRITER FIRE PUMPS, valuable as they may be, are intrinsically of little service unless available for immediate use. It is the condition of the boilers supplying them with steam which actually determines the amount of protection these pumps afford. Some valuable information on this subject was collected at Fall River last summer by the Inspection Bureau of the Associated Factory Mutual Fire Insurance Companies. It was found from tests at a number of mills that steam could not be raised from cold boilers quickly enough to save an ordinary mill plant in case of fire. On the other hand, tests made at a single mill under average conditions indicate that a banked fire kept in good condition can be stirred up quickly when the draft is good and will run a fire pump from the start if the boiler is large enough to supply it. In the tests with cold boilers, the results show in a striking way the very marked effect of the cold brickwork and flues and the rather slow rate at which all of this material warms up. In fact, it may be better in some plants to start at least two boilers when steam is wished quickly, so that the total amount of boiler fire may be greater and the heating up of the settings quicker; this plan would also ensure an ample supply of steam for the pump.

OIL FUEL is extensively employed on the steamers of the Royal Dutch Packet Co., plying between the islands of the Dutch East Indies. This is particularly interesting from the fact that the oil is the heavy residuum from the Borneo petroleum. It is stated by United States Consul Rairden of Batavia, Java, that the success of the fuel is due to the use of a special burner in which the oil is forced into the furnace under a pressure of 10 to 20 lb. without the use of steam. Steam-using burners were tried and proved objectionable.

THE COAL-HANDLING PLANT at the Treforest power station of the South Wales Electrical Power Distribution Co., near Pontypridd, is an interesting combination of electrical and hydraulic appliances. The railroad siding on which coal is received is built on an embankment and the cars are lowered from the embankment to a single track of rails on the plant level by means of a hydraulic lift, the compressor for which is driven by a 50-h.-p. electric motor. An electrically-driven winch hauls the car upon the lift. From the bottom of the lift the cars are drawn by an electric locomotive having a single 10-h.-p. motor, to the coal elevator, a distance of some 500 ft. A 35-h.-p. motor serves to tip the car, to actuate a jigger plate which shifts the coal upon a chain-bucket conveyor, and to drive this conveyor, which lifts the coal to the bunkers above the boiler house. The tipping arrangement consists of a ram which catches the axle of the truck and is lifted by means of a chain drive from the motor.

A GEOLOGICAL SURVEY OF ILLINOIS was proposed by Mr. A. Bement at a recent meeting of the Western Society of Enginers and was warmly indorsed by those present, who authorized the directors of the Society to present a memorial to that effect to the legislature. Mr. Bement pointed out that the rapid development of the State's mining industry alone was a sound reason for undertaking such a survey. The results would be of advantage to many interests. A great deal of unnecessary work in the development of natural resources by private capital would be avoided, the location of railways and drainage channels would be assisted, and the investment of capital within the State would be attracted to some extent. The plan of operations which seemed satisfactory to most of the members was that of a permanent bureau, cooperating with the federal bureau in the prosecution of the topographical work, as is the case in New York and some other States. This proposition is one deserving the support of the citizens of Illinois. Probably not one in every thousand of the taxpayers of that State will ever see a report of the survey, should it be authorized, or would care to read such a report were it received. On the other hand the data collected by these surveys have proved of distinct value in the development of the mining industry. The work of the Geological Survey of Pennsylvania has been of great importance, and in a State as rich as Illinois in coal and minerals, a similar careful survey will prove of like value. The State of Ohio is now carrying on such a work and important reports on certain specialties have been issued.

A GREAT RAILWAY UNDERTAKING was practically authorized by President Roosevelt on Feb. 7 when he signed the Philippine civil government act. One of its provisions authorizes the Philippine officials to guarantee a return of 5 per cent. on the cash capital actually needed to construct and equip railways in the islands. At the present time the development of commerce and industries is retarded by lack of transportation more than by any other one cause. A fairly comprehensive reconnaissance of the lines most needed was made some time ago. This showed that some of the lines desired by the authorities would be much more profitable than others; some of them, indeed, offer good prospects of satisfactory returns at an early date after completion.

ANOTHER GREAT PHILIPPINE PROJECT brought into prominence by the President is the comprehensive survey and scientific exploration of the islands. His recommendation for this work is based on a report to him by the National Academy of Sciences. In a message to Congress on Feb. 7 he asks for authority to appoint a board of survey, which, he states, will require at least eight or ten years for its work. This should be carried on by the United States and treated as a national duty in the interests of science, in his opinion, and the scope of the proposed investigation is best shown by the following extract from the message: "The scientific surveys which should be undertaken go far beyond any surveys or explorations which the government of the Philippine Islands, however completely self-supporting, could be expected to make. The surveys, while of course beneficial to the people of the Philippine Islands, should be undertaken as a national work for the information, not merely of the people of the Philippine Islands, but of the people of this country and of the world. Only preliminary explorations have yet been made in the archipelago, and it should be a matter of pride to the government of the United States fully to investigate and to describe the entire region. So far as may be convenient and practical, the work of this survey should be conducted in harmony with that of the proper bureaus of the goverhment of the Philippines; but it should not be under the control of the authorities in the Philippine Islands, for it should be undertaken as a national work and subject to a board to be appointed by Congress or the President. The plan transmitted recommends simultaneous surveys in different branches of research, organized on a co-operative system. This would tend to completeness, avoid duplication and render the work more economical than if the exploration were undertaken piecemeal. No such organized surveys have ever yet been attempted anywhere; but the idea is in harmony with modern scientific and industrial methods." This great project will naturally not appeal to those who believe the islands should be handed over immediately to the natives for independent government, nor to those who hold that the sole legitimate function of the United States is that of a police department. But those who believe that this country will fail in its duty if it does not discover and make known the natural resources of the islands will gladly uphold this important undertaking. At the present time, the development of the islands seems to be left to "merchant adventurers" too largely.

A NEW FORM OF FILTER GALLERY AT NANCY, FRANCE.

By E. A. Gieseler, C. E., Berlin.

The filter gallery at Nancy, France, was invented by Dr. E. Imbeaux, Ingénieur des Ponts et Chaussées and Director of the Public Works at Nancy. Dr. Imbeaux furnished the data and explanations which were used in the writing of this article.

About the time of Simpson's invention of sand filters, d'Aubuisson in France, 1825 to 1828, suggested to the city of Toulouse to take the raw water not from the Garonne direct, but from the gravel of the river valley, by means of a so-called "filter gallery" (galerie filtrante), a gallery constructed in the gravel, parallel to the river and supplied with suitable openings to collect the subsoil water. A number of cities have followed this example, while others have adopted in the place of a longitudinal gallery a line of wells, from which the water is pumped simultaneously. In France there may be mentioned Lyons, Beziers, Montaubau, Angers, Carcassonne and Nancy, and in Germany Dresden is an example.

The system was successful in the beginning, but in time a serious defect became apparent in all cases where the gallery not only collected the subsoil water coming from the hillside, but where it also intercepted the river water filtering horizontally through the strip of land lying between it and the river (respectively between the line of wells and the river). The impurities held in suspension by such river water would gradually clog the soil and in course of time more and more reduce the quantitative efficiency of the gallery. It was therefore claimed by some authorities that all filter galleries were doomed to death, "a priori condamnées à mort."

The same shortcoming showed itself where lines of wells were established in the place of galleries, but here it was comparatively easy to meet the difficulty through replacing the obstructed wells by new ones sunk into virgin soil. For the galleries, however, there was but one remedy, viz., that of continuing to extend their length in the same measure as the old parts became useless, a remedy the application of which had its evident limitations.

Dr. E. Imbeaux has studied this question carefully and has arrived at a very ingenious solution, which in certain cases appears to remove entirely the above mentioned difficulty. Generally speaking, his method consists in removing by the excavation of a trench parallel to gallery and river, that part of the soil that has become clogged, and then replacing the soil so removed by fine clean sand, which in its turn can be replaced again and again as necessity arises. In doing this it is by no means necessary to excavate and renew the whole width of the strip of land between river and gallery, which would mean a work of considerable magnitude. It has been found that the clogging of the soil does not advance any further than from 2 to 3½ m., 6.56 to 11.48 ft., and a trench of this width is therefore all that is required.

The existing filter gallery at Nancy has been remodeled with excellent success by Dr. Imbeaux, according to his above outlined method, and the writer has recently been given an opportunity to examine it under his guidance. He believes that its arrangement is of such an ingenious and original nature that engineers will take interest in the following description of it.

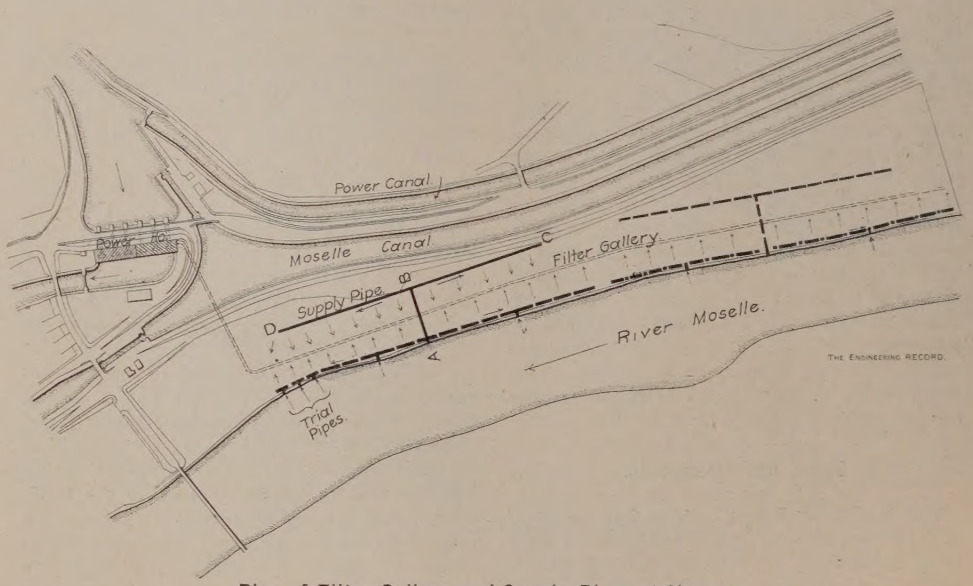
The valley of the Moselle in this vicinity is filled to a depth of from 10 to 15 m., 33 to 49 ft., by alluvium of granitic sand and gravel, washed down from the Vosges mountains, and in this material the filter gallery (see plan) was constructed in 1877. It runs parallel to the river and at a distance of from 25 to 30 m., 82 to 98 ft., from the shore. All the water intercepted by the gallery comes from the river, the surface of which is kept at this point at a constant elevation by means of a needle weir immediately below the filter gallery. Before the present remodeling of the gallery, the water entered it only on the side next to the river through three tiers of openings (barbacanes) shown on the section of the filter gallery, and through the joints of the bottom masonry, which is laid dry.

The original length of the gallery was 340 m., 1,116 ft. In the course of time its capacity declined while the needs of the city increased. The population of Nancy has risen from 40,000 in 1871 to about 110,000 in 1904. Therefore in 1891 an additional length of 200 m., 656 ft., was constructed. Still in 1897, when Dr. Imbeaux took charge of the works, the daily output had declined to 22,000 cu. m., 5,812,180 U. S. gal., in summer, and to 15,000 cu. m., 3,962,850 U. S. gal., on the coldest days in winter. After a final extension in the spring of 1899 of 70 m., 230 ft., the entire available ground had been covered, and Dr. Imbeaux now decided to put the system invented by him into practical operation.

In order to follow his line of thought in the matter, it should be remembered that the side of the gallery farthest away from the river did not assist at all in the collecting of water. This obvious defect could be remedied by the establishment on that side also of a raw water source, located at a suitable distance from, and at a suitable elevation above, the filter gallery. This second source of raw water has been established by Dr. Imbeaux in the shape of a concrete supply pipe (tuyau débitant) marked D B C on the plan and shown on the cross-section E. The supply pipe runs parallel to the filter gallery at a distance of 25 m., 82 ft., from it, and is furnished with raw water from the river by means of an aqueduct built of masonry, marked A B on the plan, and shown on the section A B, which passes over the filter gallery and at the point B discharges into a well, from which the raw water flows into the two branches B D and B C of the supply pipe. From the latter it flows through two tiers of openings (barbacanes) and the filtering medium into the filter gallery. But the water is not allowed on leaving the supply pipe to enter the natural soil direct. It first passes through a prepared bed of stones, the slope of which is revetted, and then through a prepared layer of fine sand 2 m., 6.56 ft., thick, which, as is shown on the cross-section E, can be readily removed and renewed.

In order to keep the coarse suspended matter from entering the supply pipe, the raw water is made at the point A (on the plan) to pass through three chambers (not shown on the plan or sections) filled with gravel gradually increasing in fineness. These chambers are arranged so that they can be alternately shunted out and cleaned.

On the plan, that part of the supply pipe (tuyau débitant) which has been actually constructed is shown in full lines, while the proposed future extensions are shown in broken lines. As will be seen, the existing works are only a fraction of the entire project, but when the new work was put into operation (fall of 1899) the capacity of the filter gallery increased to the full present capacity of the pumping plant, viz., 40,000 cu. m., 10,567,600 U. S. gal., daily. This filtering capacity is subject to a gradual diminution, which from time to time has to be checked by replacing the clogged fine sand in the 2-m., 6.56-ft., trench by fresh sand. The operation of renewal is not carried out along the entire length of the supply pipe at one and the same time, but the length is subdivided into sections, each of which is successively renewed in regular rotation. At present (winter of 1904), after the new system has been in operation for five years, the end of the first cycle of renewal has not yet been reached. There still remains a short length of the 2-m., 6.56-ft. trench in which the fine sand put in five years ago has not yet been renewed.



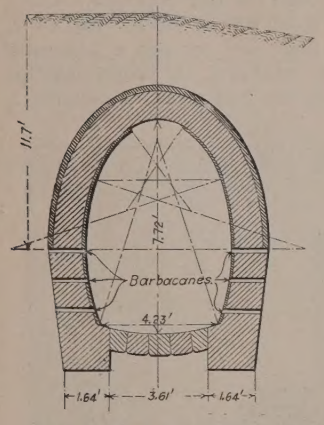
Plan of Filter Gallery and Supply Pipes at Nancy.

On the river side the natural soil that has become clogged cannot, on account of the safety of the bank, be removed. In order to re-establish the quantitative filtering efficiency there, it was decided to tunnel through the clogged river bank until the clear gravel beyond was reached, and then to construct a supply pipe as above. So far only small experiments have been made in this direction at three points indicated on the plan, but their good effect has been immediately apparent. It is intended, when future needs call for it, to construct another supply pipe at a distance of 3 m., 9.84 ft., from the river bank, and parallel to it, drawing the raw water from the river through a

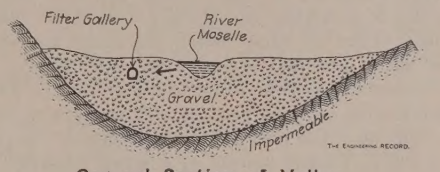
number of small intakes. When this work (shown on plan in broken lines) has been completed, there will be two supply pipes, from each of which the water will flow into the filter gallery between them, after having traversed 2 m., 6.56 ft., thickness of fine sand and about 20 m., 65.62 ft., of natural soil.

Experience shows that the fine sand in the 2-m., 6.56-ft., trenches, which retains all suspended matter, must be renewed about once every five years. This work, which consists in excavating and subsequently filling in of 3 to 4 cu. m. per linear meter (1.19 to 1.59 cu. yd. per linear foot) on each side, at a total cost of 4 francs per cubic meter ($0.59 per cu. yd.), may readily be done at a less cost by the construction of a small railroad track.

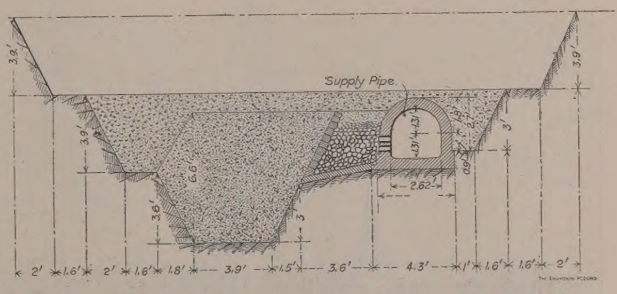
The construction of the various parts of the gallery has extended over a period of 22 years, and its cost has therefore varied. The first 340 m., 1,116 ft., of the filter gallery, built in 1877, cost 70,000 francs, $13,510; the extension of 200 m., 656 ft., built in 1891, cost 53,000 francs, $10,229; the extension of 70 m., 230 ft., built in 1899, cost 20,000 francs, $3,860. In all, the entire filter gallery, 610 m., 2,002 ft. long, has therefore cost 143,000 francs, $27,599. The



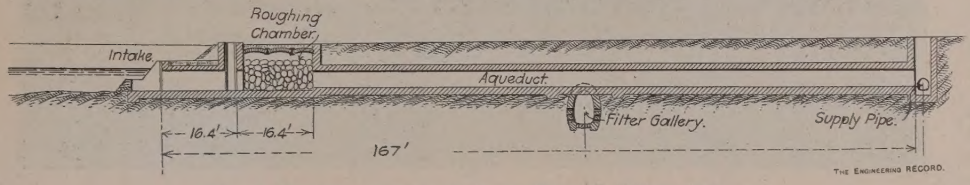
Section of Gallery.



General Section of Valley.



Cross-Section E through Supply Pipe and Sand.



Cross-Section on Line A B on Plan of Filter Gallery.

aqueduct A B has cost 5,000 francs, $965, and the intake 1,500 francs, $290. The three chambers at A, preliminary or roughing filters, cost 4,000 francs, $772; their aggregate area is 100 sq. m., 1,076 sq. ft. The supply pipe, which is 230 m., 755 ft., long, cost 21,000 francs, $4,053, which includes the excavation of the 2-m., 6.56-ft., trench and its filling with fine sand. In all the filter plant has cost about 175,000 francs, $33,775.

Besides this there were the following expenses:

1. Needle weir	30,000 francs.	$5,790
2. The filling in of the site to prevent inundation.	60,000 "	11,580
3. Cost of the land.....	28,000 "	5,404
Total	118,000 francs.	$22,774

In all, therefore, there has been an expenditure of about 300,000 francs, $57,900, for a filter plant that yields from 30,000 to 40,000 cu. m., 7,925,700 to 10,567,600 U. S. gal., daily at present, and that can readily be raised to a daily capacity of 50,000 cu. m., 13,209,500 U. S. gal.

It may be of interest to state that the bacteriological results of the filtration are fairly good. Out of 800 to 1,000 bacteria per c.c. in the raw water, from 40 to 80 pass into the effluent, which is equivalent to an average removal of about 93 per cent.

It should be mentioned that the water of the Moselle at Nancy is a particularly clear river water except in the rare cases of floods, and this feature must be looked upon as essential for the success of the filter gallery system, even when improved according to Dr. Imbeaux's method, for which latter he himself is far from claiming general applicability.

An Electrically Driven Flour Mill.

A paper read before the annual convention of the Indiana Engineering Society by Mr. O. C. McMeans, of Indianapolis.

Many of those present have no doubt been following with interest the series of articles which are now appearing in the "Electrical World and Engineer," under the title of "Niagara Power in Buffalo." In the first of these articles, published in the issue of Dec. 3, 1904, there was given a list of the various manufacturing industries and other users of power supplied by the Cataract Power & Conduit Co. The second name in this list is that of the George Urban Milling Co., of Buffalo. The flouring mill plant of this company is not only unique in that its only source of power is the electric current transmitted from the great waterfall, but it is also interesting as being a late example among the larger mills of this country of modern methods and ideas in the manufacture of wheat and flour.

The mill was erected in the summer of 1903. The building was designed by the A. E. Baxter Engineering & Appraisal Co. of Buffalo, N. Y. It is of brick, five stories high, with slate roof. The floor construction is of combination steel and wood, the columns and girders being of steel, and the heavy floor joists of wood, with wood floor. The grain-cleaning machinery is installed in a special department at one end of the building, separated from the mill proper by a brick fire wall extending above the roof, and broken only by door openings covered with automatic fire doors, and by a few small openings for grain spouts. The electric equipment for power and light is installed in a room in the basement entirely enclosed by brick walls with concrete arches above. The only opening from this room to the mill is that for the main shaft. The drive for the cleaning machinery is taken along the end wall entirely outside the building. Standing as the mill does in the level country, remote from any suspicion of water power, the absence of the usual tall stack or escaping steam is very noticeable. The equipment of machinery was designed and installed completely by the Nordyke & Marmon Co., of Indianapolis. The capacity of the mill is 1,000 bbl. of wheat flour and 150 bbl. of rye flour per 24 hour run. The wheat flour is made from a mixture of hard and soft wheats, and is of the ordinary kind from which the staff of life is made. In other words, this mill is in no way to be associated with the numerous plants making breakfast foods and such preparations. It is a flouring mill, pure and simple.

The mill is driven by one 400 h.p. synchronous motor operating under 2,200 volts, at a speed of 250 r. p. m. For lighting and incidental power purposes the electrical equipment also contains one 20 kw. transformer at 440 volts, two 7½ kw. transformers at 220 volts, and one 20 h.p. motor operating at 220 volts. Power is taken through friction clutches on both ends of the 400 h.p. motor direct to sheave wheels, from which the distribution of power is by means of manila ropes. The drive at one end carries all the wheat cleaning and receiving machinery, while the flour and rye mill are driven from the other end. The manila rope in these drives is 1¾ in. in diameter, running over nothing less than 72-in. sheave wheels. The speed of all main shafts is the same as that of the motor, 250 r. p. m. The rope has a velocity of 4,750 ft. per minute, or very close to the most efficient speed for manila rope transmission. The rope drives are on the American or continuous system, employing four automatic tension carriages. The mill is driven by 14 ropes and the cleaning machinery by 4 ropes, or 18 ropes in all to transmit the entire power of the motor. This gives a normal load of 22.2 h.p. for each 1¾-in. rope at 4,750 per minute, or about 50 per cent. of the safe working load usually taken for this speed.

Coming now to the mill machinery proper, a brief description would place the plant as among those using the full roller system of grinding and the sifter system of bolting. The flour mill of to-day must, as a whole, be considered as a single automatic machine. The various elements composing it are connected by conveying and elevating devices for the handling of the products, and all are driven from the common source of power at nicely adjusted relative speeds. Thus it is that when in proper running order, no manual labor whatever is required of the operatives, whose sole duty is to attend to the oiling and adjustments of the machines, and watch for accidents, breakdowns or chokeups.

Grain is received from cars by power shovels onto a 24-in. rubber belt traveling at 600 ft. per minute through a tunnel leading into the cleaning department of the mill. Here it is discharged into a large receiving elevator, which lifts it to the top of the building. After a preliminary cleaning the grain is again elevated and spouted into a steel storage tank of 60,000 bush. capacity located immediately over the receiving tunnel. When wanted for grinding, two steel conveyors, located in the tunnel, carry the grain from the tank into the cleaning department. One conveyor carries hard wheat, the other soft wheat, these streams being kept separate all through the cleaning process, and delivered into separate steel stock bins over the first break rolls. The hard wheat is tempered with water and allowed to stand from six to eight hours in steel tempering tanks 60 ft. high.

The separate machine elements entering into the general milling system may be divided into

three classes according to their functions, that is, the grinding, bolting or sifting, and purifying, although this last is sometimes included in the bolting class. In the mill under construction the grinding machinery comprises 24 double roller mills. For the break system there are four double 10x36-in. mills and six double 9x30-in. mills. This gives 648 in. lineal contact of rolls, or about 65 in. per barrel capacity in 24 hours on breaks. There are five breaks on wheat, that is, the wheat is passed five times through the break or corrugated rolls, before the middlings are thoroughly removed from the bran. Between these successive breaks the product of broken wheat, bran and middlings is elevated to the sifter and graded over wire cloth, only the coarser particles being returned to the next break. In the smooth roll system for grinding the purified middlings into flour, there are 14 double 9x30-in. mills. This gives 840 lin. in. of smooth roll contact, or 0.84 in. per barrel capacity in 24 hours. The total roll surface, as it is technically termed, on breaks and smooth roll reductions is 1,488 in., or 1.49 in. per barrel capacity in 24 hours. In this mill the amount of roll surface for the breaks is rather large, for the reason that there are two separate systems for hard and soft wheat, both as to grinding and bolting as far as the fourth break.

The grading and bolting of the products of the rolls is accomplished almost entirely in nine gyratory sifting machines. These are the square sifters of the Nordyke & Marmon Co., of the size known as No. 4. Each machine contains 108 sieves 24¾ in. square. These sieves are in four stacks or compartments, of 27 sieves each, within the wooden case of the machine, the whole being given a circular gyrating motion in a horizontal plane. The radius of this motion is 2 in. and the speed 180 gyrations per minute. The action of the sieves under this motion is very similar to that of the ordinary hand sieve. The net area of cloth on each sieve is 2.8 sq. ft., which is 2.72 sq. ft. of sifter cloth per barrel capacity in 24 hours. There are, in addition to the sifters mentioned, six differential reels each 26 in. in diameter by 8 ft. long. These are used in bolting the low grade stocks where a more forcible action is necessary. The principle of these reels is that of a slowly revolving drum covered with silk bolting cloth, inside which are a set of rapidly revolving beaters which dash the stock against the cloth.

A part of the product resulting from the sifting of the ground stock from the break rolls consists of the sharp granular particles of the starchy interior of the wheat berry, termed middlings. It is from these middlings that the finest of flour is produced, and the supreme effort of all systems of milling wheat into flour is now directed to the production of the highest percentage of middlings possible from the break stocks. Very little flour is produced in the break rolls, and what is unavoidably made is carefully bolted out at once and sent to a second grade of flour, so that the middlings are, to use a miller's term, "dry." After the very thorough grading in the sifters, there remains in the middlings a considerable percentage of branny particles which cannot be separated by mere sifting action. The office of the middlings purifier comes in here to supplement the sifting action with that of air suction. The stream of middlings flows over a slightly inclined sieve of silk bolting cloth, being at the same time subjected to a gentle current of air which lifts out the branny and fluffy particles. The middlings are thus left clean and white, so that there is nothing further needed but the grinding on smooth rolls to produce the finest or patent flour, which is obtained directly from the sifters handling the stocks from the middlings rolls. In the mill in question there are twelve purifiers, the greater number of which handle the middlings direct from the sifters, while a few are used for repurifying the products of the primary machines.

The dust resulting from the operation of the middlings purifiers, as indeed all dust produced in the mill from grain cleaners or other machines, is blown directly from the fans into dust collectors of the cloth tubular type. These consist of a large number of tubes of cotton flannel open at the end. The dust laden air enters the open end and emerges through the cloth sides, leaving the dust inside. Automatic cleaning devices remove the accumulated dust, which is bolted to regain anything of value in it.

Six No. 15 perfection dust collectors are used for the purifiers, one for each two purifiers.

The friction of the rolls in grinding results in quite a noticeable rise in the temperature. The warm, moist air, if allowed to remain in the roller mill casting, would result in condensation in the spouts and a doughing up of the products. This warm air is removed through aspirating pipes to a suction fan, whence it is blown into dust collectors which catch the small amount of floury dust that is drawn off with the air.

The finished flour is spouted directly into the metal bins over the packers. These bins are of a sufficient size only for a few minutes' run of the mill, serving merely as a small reserve to cover irregularities in packing. The flour is in regular operation packed from the stream as it is produced, there being at the greatest an interval of some thirty minutes from the time the wheat enters the first break roll until the flour and bran are in sacks in the warehouse.

Considering the size of the plant it is worth noting that upon its completion it was started at full capacity and has been operated day and night ever since. The only serious interruption was caused by the development about a week after starting of a flaw in a 3½-in. shaft in the cleaning house, causing a complete wreck of the rope drive to this department, and necessitating a shut down of three days.

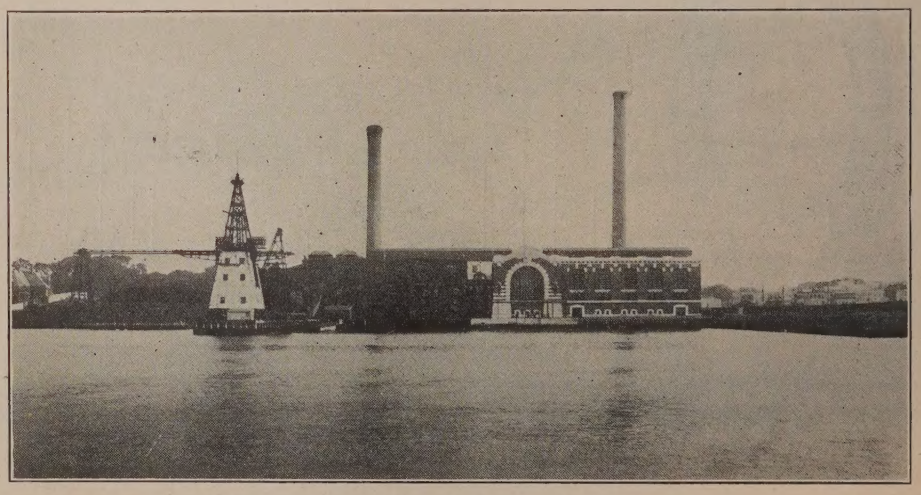
The 268-Foot Water-Power Plant near St. Catharines, Ont., that draws water from the Welland Canal, has, during the past year, had its canal and reservoirs that formerly had an area of 40 acres increased until they now measure 450 acres. It is stated that the storage basins may be lowered 3 ft., so that they can deliver a volume which is equal to that which may be drawn from the Welland Canal during 23.33 hr., at the rate of 700 cu. ft. per second, allowed in the water-power grant.

The Steam Turbo-Generator Station of the Edison Electric Illuminating Co., Boston.

One of the most interesting stations in which steam turbines are used is the South Boston power house of the Edison Electric Illuminating Co., of Boston. A number of papers describing various features of it have been read before different engineering societies, the American Institute of Electrical Engineers among others, by Mr. I. E. Moultrop, the company's mechanical engineer, and from them the following notes relating to the steam equipment have been prepared. The station is planned for twelve 5,000-kw. units, and the description covers the plant as projected, although the initial installation is for 10,000 kw.

General Design.—The station property is located in South Boston, at L and East First Sts., and has an area of about 25 acres, two-thirds of which is solid land. The value of the real estate is very small. Under these conditions, it is cheaper to spread out the buildings on the ground than to carry them up in the air to an equivalent area, and liberal room for and around the apparatus facilitates the operating, cheapens the cost of making repairs, and renders it easy to keep the stations clean.

The turbine room will be 650 ft. long, 68 ft. wide, 56.5 ft. high, and without a basement. It has no side windows. A liberal monitor with glass sides and roof gives, he believes, a better distribution of daylight than do side windows, and in connection with windows in the end walls provides good ventilation. The boiler house will be 640 ft. long, 149.5 ft. wide and of same height as the turbine room. The arrangement of the boilers practically divides this building into seven fire-rooms. The lighting and ventilating is done from the roof similarly to the turbine room. The switch house will be 605 ft. long, 30 ft. wide, and several stories high. The buildings for the installation of 60,000 kw. of machinery cover about 160,000 sq. ft., which is equivalent to about 2.67 sq. ft. per kilowatt.



View of Old and New Stations from the Harbor.

The ends of the buildings facing the water have been made the front of the station with an entrance through offices located in the front end of the switch house. The buildings are set back 136 ft. from the sea wall, the intervening space covered with a fine lawn and planted with shrubbery. Through the center of this lawn a paved driveway leads from the ornamental entrance gates on L St. to the office entrance.

The turbine room has received all of the machinery in the station; even the boiler-feed pumps usually considered an adjunct of the boiler house, are treated as part of the turbine

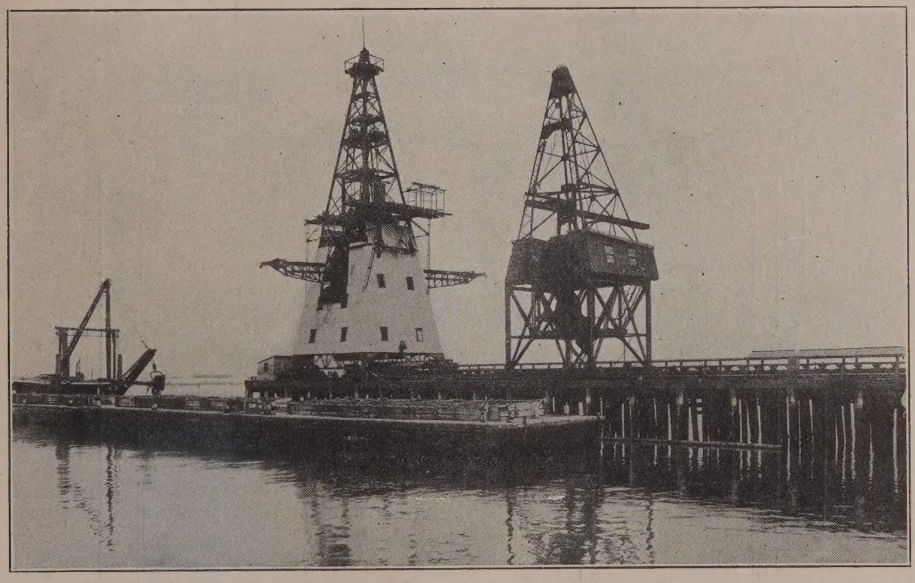
auxiliaries, and are placed in charge of the turbine operators. The boiler house contains only the boilers with the necessary piping, etc., so that the work in this room is to burn coal properly and maintain the steam pressure.

All of the electrical apparatus has been grouped together and installed in a separate building adjoining the turbine room, isolated from the noise and dirt of the latter and free from liability of damage by accidents to any of the turbine-room machinery.

The turbine-room floor is tiled in dark red with black borders arranged in the form of a simple design to relieve the monotony of one color. The walls have a wainscot of two-colored green tile about 10 ft. high, and above they are paneled with a light-colored tile and enameled brick. The crane track is concealed by the wall finish. This room is divided into three parts by permanent division walls in which are large doors at the floor level, and large windows above, all equipped for quick closing. In each room there is to be a 50-ton Niles traveling crane with 10-ton auxiliary hoist. Cost estimates were made on the various possible methods of satisfactorily finishing the rooms, including the up-keep for an extended period of years, and the finish employed was found to be correctly. The duplication of auxiliaries is eliminated, and should a generating unit be put out of commission by the failure of any one of its essential parts, it is intended that the entire unit will be shut down and another one started in its place.

The advantages of the turbine over the engine in first cost, the lesser amount of help required to operate, the ability to use condensed steam with safety for feed in the boilers, together with the fact that the apparatus takes very much less room, decided the question of the type of prime mover in the favor of the turbine. These considerations were held to justify the decision without regard to the water consumption.

The turbines used in the first installation are of the Curtis type with a rated capacity of 5,000 kw. They are four-stage machines with surface condensers built in their bases and are equipped with mechanical brakes for bringing the machine to rest for an emergency stop. The base condenser was adopted because it will give a somewhat better vacuum in the turbine, which is an important consideration in turbine work. It also considerably reduces the floor space required for the installation, somewhat simplifies the piping, and makes possible a



The Coal Unloading Towers on the Station Wharf.

the cheapest that could be adopted, being even less expensive than painting. The exterior of the station buildings is simple and massive in character. Cut granite underpinning is used and the prominent walls are faced with a dark paving brick trimmed with terra-cotta.

Equipment of the Turbine Room.—The apparatus is installed on the unit system. In the turbine room all the auxiliaries required for a generating unit are grouped around that unit and are generally of sufficient capacity to serve that unit alone. The boilers necessary to supply the generating unit are in one row directly behind the turbine. In this way each generating unit is a small central station in itself. Practically no cross-connections are installed between the various units except that between each pair of units. The steam mains are joined by a small-sized tie, so that a generating unit can be run temporarily from the boilers of its mate, should an emergency require. In this way a very simple piping system is sufficient, reducing the cost of installation and maintenance, and simplifying the manipulation of the station under emergencies when the engineer has to think quickly, and when he must be sure that the manipulations are made rapidly and more symmetrical and pleasing grouping of the machinery. Its disadvantage is that it increases the height of the turbine a few feet, which is, however, of little moment. Its first cost is somewhat more than an independent condenser, which may be partly balanced by the saving in piping; and it requires special arrangement for filling the condenser tubes with water when the turbine is to be non-condensing. The brake also facilitates the overhauling of the step bearing by sustaining the weight of the rotating parts.

The generator is a three-phase alternator, Y-connected, 60-cycle machine, generating at 6,900 volts. The running speed is 514 r.p.m. The revolving field is 8 ft. 8 in. in diameter and weighs 67,000 lb. The total weight of the turbine above the condenser is 115 tons.

The auxiliaries for each turbine consist of a circulating pump, a wet and a dry vacuum pump, a step pump, a hydraulic accumulator, and the boiler-feed pump for the group of boilers connected to the turbine. All these machines are steam-driven with the exception of the wet vacuum pump, which is motor-driven, because its speed is too high to be conveniently handled by an engine. Careful consideration was given to the subject of steam versus electrically-driven auxiliaries, and steam was determined upon on the ground that it gave better station economy. All the exhaust steam from the auxiliaries is carried to the feed-water heater and is condensed in heating the boiler-feed. The condensation is then discharged to the sewer as it was felt that it contains too much cylinder oil to warrant trying to purify it. All the exhaust from the auxiliaries can be condensed in heating the feed-water. Moreover, the argument was that the first cost of steam-driven auxiliaries is less than electric drives, and speed regulation over wide ranges is much more easily accomplished.

The circulating water-pump consists of a 24-in. volute type of centrifugal-pump direct driven at 250 r.p.m. by a 15x15-in. Harrisburg high-speed engine with a throttle governor. The quantity of water to be handled is very great, and the head very low, so that a centrifugal-pump is well adapted for this duty. It also makes a much smaller machine than a piston-pump, and it was favored as being less expensive and at the same time simple and requiring almost no attention.

The distinctive feature of the dry vacuum-pump is that the 24x18-in. air-cylinder is placed at a right angle to the 10x18-in. steam-cylinder, thus giving a better turning moment on the crank, and it takes less room. The air end is built single stage, and, it is stated, will maintain a vacuum on a closed tank within one-half inch of absolute. The steam end is throttle governed to permit of speed variations while running.

The wet vacuum-pump consists of a 4-in. two-stage centrifugal-pump, motor driven. This pump, it is further stated, will maintain a vacuum in the condenser equal to that of the dry vacuum-pump without the use of either suction or discharge-valves; thus requiring a minimum amount of repairs and almost no operating attention.

The boiler feed-pump is an ordinary duplex, center-packed plunger-pump 17x12x15 in. in size, selected because it is easy and quick to repack, and a casual inspection will show if there be leakage from the plungers.

The group of boilers supplying each turbine unit has its own feed-water heater, which is of the National make, of the coil type, and this is likewise placed in the turbine room. It is installed close to the boiler-room wall and immediately over the boiler-feed pump so that there is a good head of water through the suction valves of the pump. It is supported by a gallery which also carries the hot well. The latter is simply a tank for the storage of feed water sufficient to run the boilers for some 10 min. and serves to compensate for variation in the demand and supply. The heater and hot-well galleries are erected behind each turbine on the turbine-room wall and level with the boiler-room floor. Between the heater galleries for each two turbines and joining them is an observation gallery.

The step on the turbine is lubricated by water instead of oil, because the water is as good a lubricant for this purpose, is cheaper, and the lubricating system simpler. The water is forced into the step under a pressure of about 1,000 lb. by a steam pump of similar design to the boiler feed-pump. As even a momentary stoppage of the water supply to the step would result in damage to the bearings, a motor-driven triplex-pump, which can be started much quicker than a steam-pump, is installed as a relay to the main step-pump. To obviate fluctuations in the pressure due to the pump's reversing its stroke, a weighted hydraulic accumulator is used. This is made of sufficient capacity to keep the step supplied with water for

10 min., thus giving time either to shut down the turbine by means of the brake or to put the relay-pump in service, should the steam-pump fail.

The condensing apparatus is designed to condense 153,000 lb. of steam per hour and maintain a 28-in. vacuum in the condenser, with the cooling water at summer temperature of 70° Fahr. The same apparatus under winter conditions and when the heaviest loads occur on the station, will, according to Mr. Moultrop, give a vacuum within about ¾ in. of the barometer. Each condenser has 20,000 sq. ft. of cooling surface, and has four passes for the circulating water and is especially designed for this service. The tubes are 1 in. in diameter, 16 ft. long, of brass. The shaft of the turbine runs down through the center of the condenser to the step bearing which is brought down near the base of the condenser so that it is accessible from the passageway which runs through the concrete foundation of the machine. The condenser and pumps were furnished by H. R. Worthington.

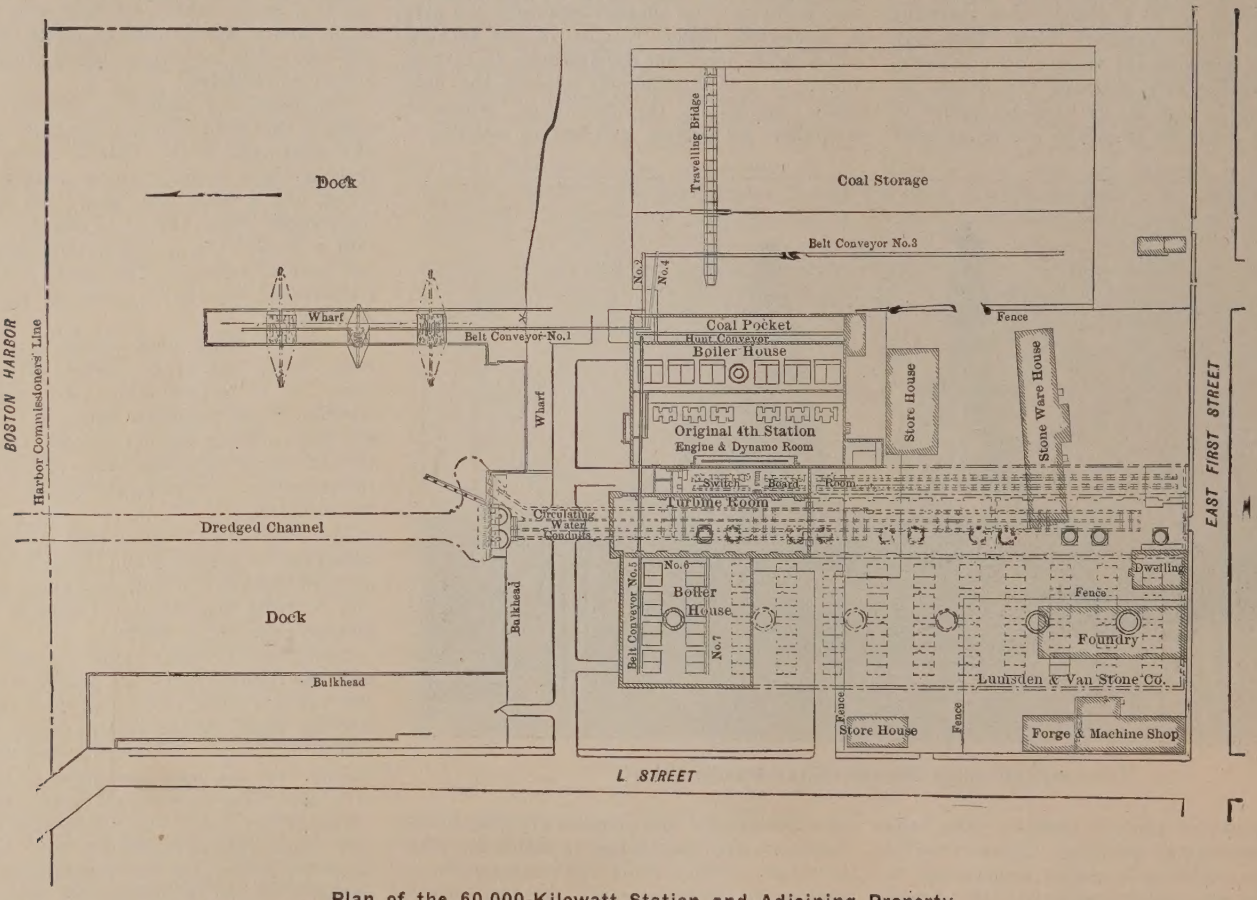
The cooling water is conveyed to the pumps by brick tunnels running under the center of the turbine-room, at such grade that they are always flooded, and constructed within the building so that the machinery can be installed above them. For additional insurance, two tunnels are provided for the incoming water, each supplying one-half the station. The tunnels are all built horseshoe section for strength, the two incoming tunnels of 56 sq. ft. cross-section and the discharge tunnel of 78 sq. ft. At the tunnel intakes there is a submerged rack for keeping out driftwood and two nearly rectangular openings 5.5x13 ft. through the seawall, for each suction tunnel. Each opening leads into a screen chamber where there are two sets of fine copper screens placed in series so that one set may be removed and cleaned while the other set is in use. From each screen chamber there are two openings leading into a semi-circular gate chamber where the suction tunnels begin. The arrangements described have been made so that when only one-half of the station is running one of the suction tunnels can be cleaned. As the flow of water in the discharge tunnel is outward it is not expected that the latter will ever require cleaning. The water-front construction is of concrete with a wing-dam so designed that, while the warm discharge-water empties into the harbor alongside of the incoming tunnels, the latter tunnels get cold water without danger of taking any of the warm discharge water.

Equipment of the Boiler House.—The rows of boilers are placed in pairs alternately face to face and back to back, with a chimney for each pair. Thus six chimneys in all are required, each being 230 ft. high above the level of the grates, to dispense with forced draft. They are of the Custodis type, as described in some detail in The Engineering Record of Oct. 10, 1903. Building the chimneys between the rows of boilers, considerably increases the ground area of the boiler-house, but the additional space is very useful for work-room, toilet-rooms, etc. The boilers are elevated from the ground, being 18 ft. above the basement floor, which itself is level with the turbine-room floor, to provide liberal space in the basement for the ash handling. Large brick chambers immediately below the boiler furnaces collect the ashes, and discharge through valves in their bottoms into carts or cars on the ground floor.

The ash-room has a free circulation of air at all times through openings in the exterior walls provided with grilles. In the front wall of each ash-chamber, close to the fire-room floor, are openings equipped with dampers admitting air directly to the ash-pits, permitting the windows and doors in the fire-room to be closed during extreme weather conditions.

A portion of the basement under each two rows of boilers is separated from the ash-room by partitions forming the pipe-room. Immediately under each row of boilers in this pipe-room are installed all the various pipe-mains which connect with them, and only branch pipes to each battery of boilers are taken into the fire-room. This puts the most of the boiler-room piping into a warm, clean room by itself where it is accessible, free from cold drafts which would tend to start leaks, and where it can be carried upon substantial supports.

In the boiler house between each two rows of boilers and adjoining the turbine-room wall are located the vestibules which furnish means of communication between the two buildings. There are six of these, each equipped with a broad easy flight of ornamental iron stairs with slate tread leading from the ash-room floor level to the broad landing at the level of the boiler-room floor. At the lower level copper-covered doors connect with the ash rooms and pipe room and also the turbine room, while at the upper level similar doors connect with either boiler room. A door in the turbine room wall leads to the observation gallery in the turbine room.



Plan of the 60,000-Kilowatt Station and Adjoining Property.

Supplying each row of boilers is a line of coal-bunkers built of reinforced concrete in monitors above the roof. As there is practically no piping on top of the boilers, little space is needed above them, and building the coal-bunkers in monitors enables the boiler-house to be made quite low, saving considerable expense in the cost of the structure. As there is always a large amount of coal stored alongside the station, the capacity of the bunkers is made small, about 44 tons per boiler, being sufficient to last during the time of making routine repairs in the coal-conveying system. This reduces the cost of the building very materially.

The boilers are of the Babcock & Wilcox water-tube type. Each is rated at 512 boiler horse-power, is 18 tubes wide and 14 tubes high, has two drums and is built for a working pressure of 225 lb. Installed in the first and second passes of each boiler is a Babcock & Wilcox superheater designed to deliver steam at the

boiler outlet superheated to 150° Fahr. The boilers are equipped with Roney mechanical stokers which have 110 sq. ft. of grate area each and are operated by induction motors. The coal is fed down by gravity through the chutes leading out of the bottom of the overhead bunkers direct to the stoker hoppers. In connection with these chutes are installed weighing hoppers hung on scale levers so that the coal fed to each boiler can be accurately weighed. The amount of superheating was made conservative to be sure that the temperature would not cause trouble with flanged joints and in the steam-cylinders of the auxiliaries. The attached type was selected because they took no additional room and were self-regulating.

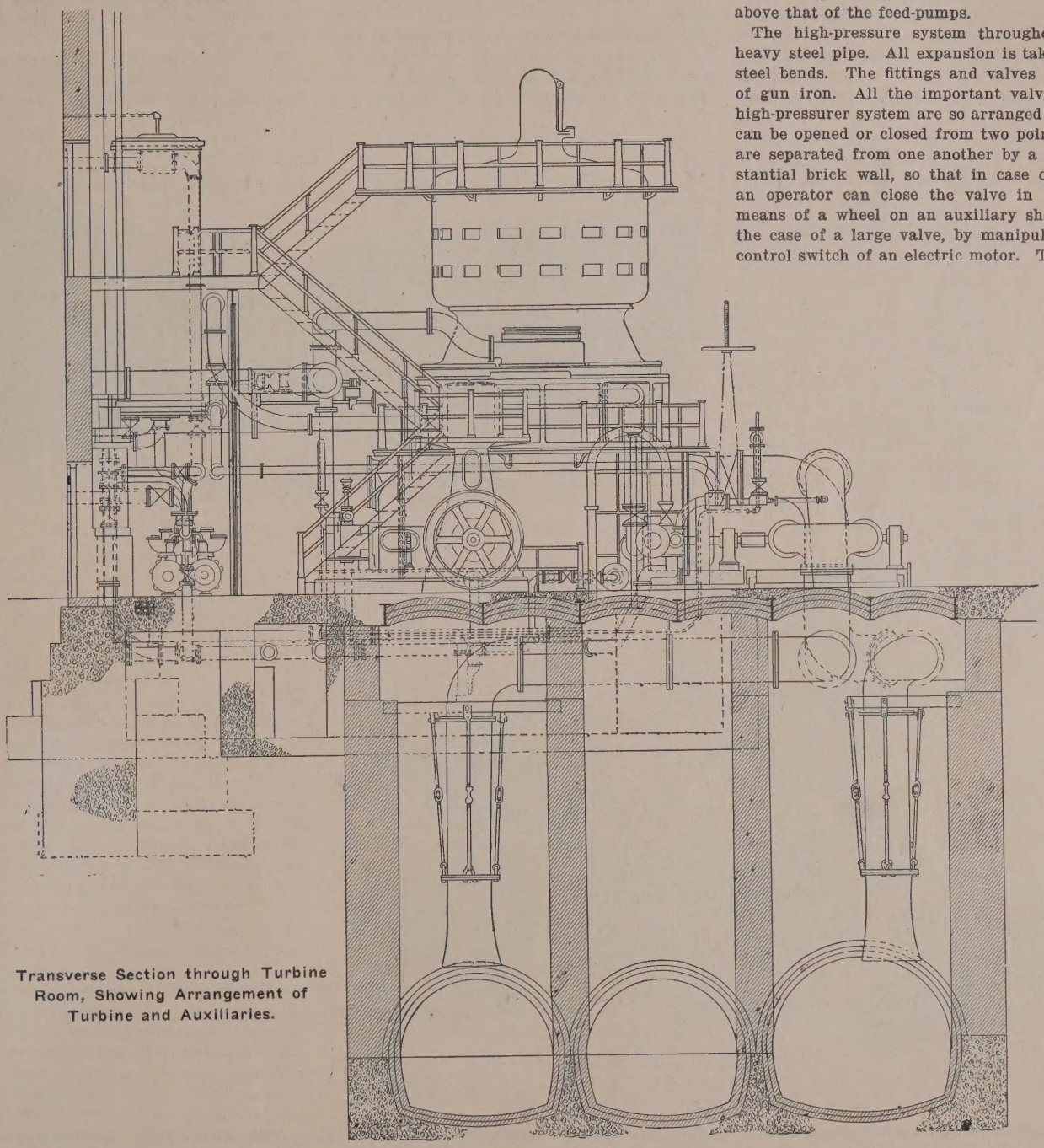
The coal storage provides for 60,000 to 70,000 tons. The wharf is equipped with an electric tower, operating a 1-ton clam-shell bucket on the Ward-Leonard system and one electrohydraulic tower, constructed by the Robins Conveying Belt Co., operating a similar bucket of 1.5 tons. The electrohydraulic tower is a new design in which hydraulic-elevator cylinders of the Otis type furnish the power for operating the bucket. The water pressure is obtained by a three-stage centrifugal pump driven by an induction motor. This pump is automatic in its action, and when the water pressure reaches the maximum point the pump continues running and maintains that pressure without delivering any water until the pressure drops. The tower is operated by one man with a minimum amount of physical exertion.

The coal is conveyed from the wharf to the storage-yard by a system of Robins conveying belts, the conveyors from the wharf to the yard having a maximum capacity of 700 tons of coal per hour. This conveying system was adopted because it was considered possible to obtain large capacity when desired, with a minimum amount of attendance and repairs.

The storage-yard is equipped with a Brown electric reclaiming-bridge which operates a clam-shell bucket of the usual type and of 2 tons' capacity. This bridge is so installed that it will cover the entire storage-yard, and besides taking coal from the field and putting it on to the conveyor running into the station, it is very useful to turn over the coal quickly should it show signs of heating. All the machinery for operating the bucket is installed on a trolley car running on the deck of the bridge. The operator riding on this trolley is always immediately over his work, and can control the motions of the bridge at the same time he is operating the bucket.

The water-supply service includes a system of storage-tanks, with a combined capacity of 50,000 cu. ft. of water or sufficient to run one turbine on the condenser for about 10 days. They are placed at an elevation considerably above that of the feed-pumps.

The high-pressure system throughout is of heavy steel pipe. All expansion is taken up on steel bends. The fittings and valves are made of gun iron. All the important valves of the high-pressurer system are so arranged that they can be opened or closed from two points which are separated from one another by a good substantial brick wall, so that in case of trouble an operator can close the valve in safety by means of a wheel on an auxiliary shaft or, in the case of a large valve, by manipulating the control switch of an electric motor. The equipment of all the large valves with motors not only saves time in opening and closing, but enables one man to manipulate several valves at once. The water piping is in general of cast-iron with the principal exception of the warm boiler-feed line which is of flanged copper pipe in the larger sizes and brass pipe with screwed joints in the smaller sizes.

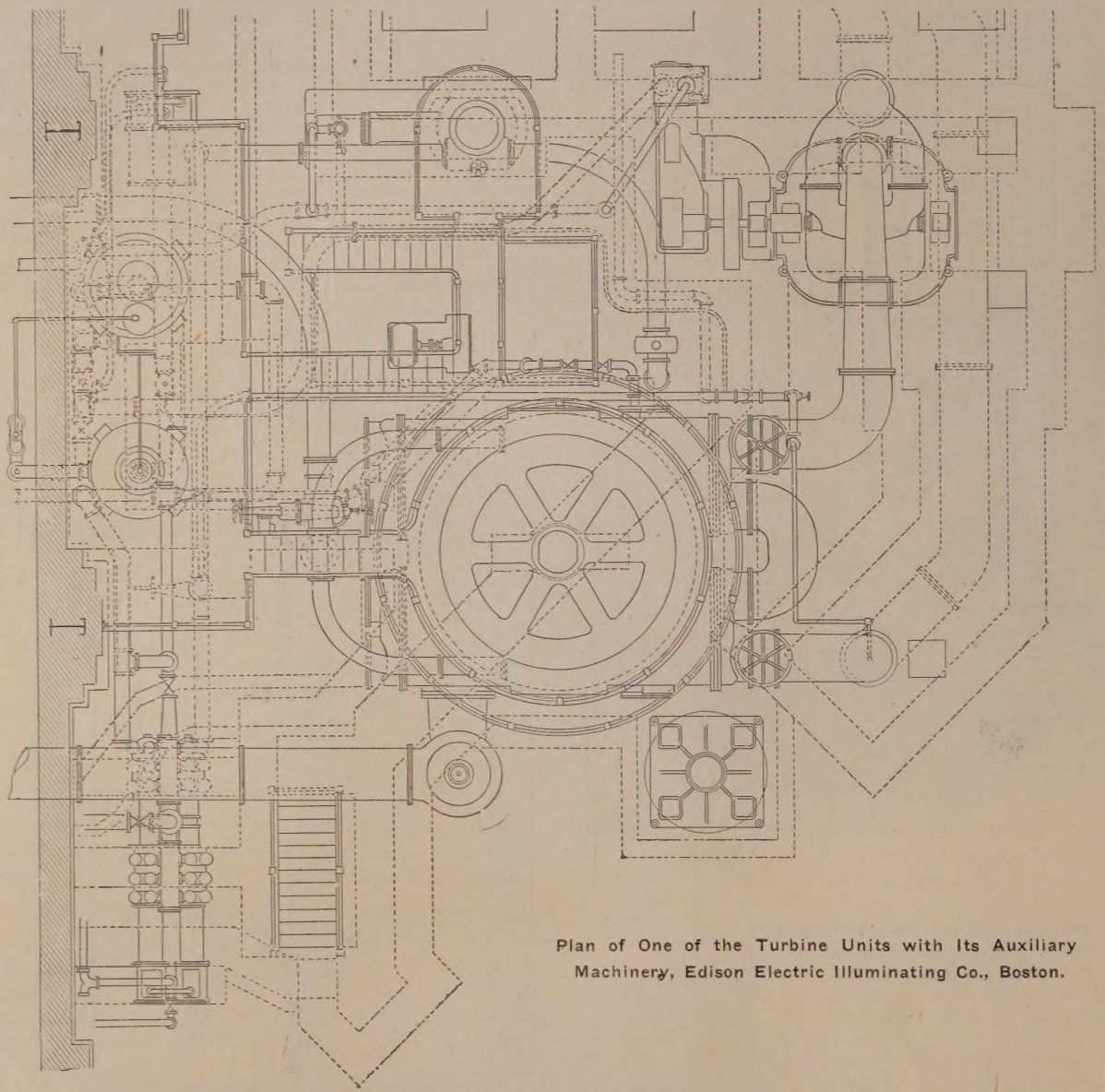


Transverse Section through Turbine Room, Showing Arrangement of Turbine and Auxiliaries.

Electrical Apparatus.—The switch house proper is three stories high. The first story, being a cable chamber, is quite low, and the ducts from the street system terminate in this room, immediately under the point where the cables rise through the floor above. The second

story is occupied by the bus bars and the instrument transformers, and the third story contains the high-tension oil switches. In about the central portion of the switch house, for a distance of about 120 ft. long, another story is added. This is the operating room and contains all of the instruments, the controls for the oil switches, the field rheostat controls, the field excitation appliances and the signal systems, etc. All of the high-tension apparatus is in the lower rooms and nothing but low-tension or secondary current is brought to this floor.

The barriers in the bus-bar compartments and also in the instrument compartments are of reinforced concrete with a fine, close-grained finish. These are all made in moulds and set in place similarly to slabs of alberene; they have as good insulating qualities as alberene, according to Mr. Moultrop, with less absorption, are much cheaper, and furthermore are less liable to break. The bus-bar chambers are fully enclosed, small doors being left in the wall for access to the connections only. The front of each switch-cell is enclosed with a wooden frame filled with a pane of glass which permits an inspection of the pot, while at the upper part of the frame there are a few slats for ventilation, and for vents in case of an explosion. The controller panels, with all the necessary instruments, are grouped in the operating room in the form of a rectangle, facing inward, so that the operator can see at a glance any panel in the room.



Plan of One of the Turbine Units with Its Auxiliary Machinery, Edison Electric Illuminating Co., Boston.

The Pasadena, Cal., Sewer Farm.

By T. D. Allin, City Engineer.

Pasadena's sewer farm, which until recently comprised 300 acres, is situated 4½ miles southeast of the center of Pasadena, and one mile southeast of the center of the town of Alhambra. On account of the simple method of sewage disposal, which has proved so highly satisfactory from a sanitary standpoint and so remunerative from a financial standpoint, Pasadenans refer to their sewer farm with much pride.

The 300 acres were purchased in 1887 at $125 per acre, which at that time were unimproved. Many obstacles were encountered by the city officials who undertook to acquire the farm and secure the right of way for the main outfall sewer leading thereto, not to mention the difficulty encountered in the disposal of the sewage after the legal entaglements had been settled and the outfall completed. From the south city boundary to a point ½ mile from the sewer farm, the main outfall runs along Garfield Ave., which passes through the extreme eastern part of South Pasadena, a separate municipality incorporated in 1888. Leaving South Pasadena, Garfield Ave. continues on through Alhambra, passing through the business center of the town, which is now also a municipality incorporated a year ago. As that part of South Pasadena through which the outfall was to pass was sparsely inhabited and the land was owned in large tracts, but little difficulty was experienced in securing a right of way. In Alhambra conditions were different. Much of the land along and near Garfield Ave. had been subdivided into residence and business lots and many houses and some business buildings had been erected. It was there that delay and litigation were encountered. Not only did the city officials have the Alhambra people to contend with, but many of the most influential citizens of Pasadena believed it unjust for Pasadena to carry its sewage through the streets of a neighboring town, and dispose of it on a sewer farm in its vicinity.

The contract for the construction of the outfall was let in the fall of 1887, and very soon thereafter injunction suits were brought to prevent its construction. After many delays the city won the suits, wherein the ruling of the court was to the effect that it had not been proved that the outfall would be any more unsanitary than other sewers constructed upon the streets of cities in general, and that in the failure to prove damages the franchise secured by the city from the Board of Supervisors to construct the outfall along Garfield Ave. was sufficient.

The outfall was finally completed in 1892, and at once thereafter connections were begun with the several city sewers which had been completed some three years, but had remained unused until the outfall could be completed. The main outfall is of salt-glazed vitrified pipe vary-

ing from 16 to 20 in. in diameter, and is on grades ranging from 1 to 3.5 ft. per 100 ft.

The first pipe on the farm for the purpose of distribution was a 12-in. pipe along the entire west side of the farm, with one lateral running eastward at about the middle of the south field. A year ago another line was constructed, running eastward from the main sewer at the northwest corner of the farm and then south through the center of the farm to near the south boundary. At points from 400 to 500 ft. apart, both on the old and new lines, outlets are placed controlled by gates, whereby the sewage can all be taken out at one opening or can be taken out at several openings at the same time, as is most convenient to cover the area being irrigated. From the openings head ditches are run from which lead many parallel furrows from 2 to 6 ft. apart, covering the entire area being irrigated.

The first crops raised consisted of barley and wheat hay, pumpkins, corn and alfalfa, all of which are now successfully raised, except alfalfa, which, being a matted low-growing crop, the roots of which incline to sod, and cultivation being impossible, the solids of the sewage would collect in it on the side of the field next to the head ditch and the results were unsatisfactory. It was finally decided to abandon the raising of alfalfa, although the yields were extraordinary and the profits excellent.

In 1892 60 acres on the south end of the farm were planted to English walnuts. The trees having made splendid growth, an additional 30 acres were planted in 1898, and last spring another 27 acres were planted, making 117 acres in walnuts. During the first few years corn and pumpkins are raised in the walnut groves, but as the groves come into bearing no other crops are raised. The sewage is turned into the bearing groves as soon as the leaves are well off the trees which usually is about Dec. 1. It is not safe to unduly saturate the ground while the trees are in foliage as a heavy wind, from which the locality is unusually free, would be disastrous to the trees.

The sewage is kept in the walnut groves until the foliage comes out on the trees about April 1, the entire flow for the past three or four winters having been disposed of in the groves. After the sewage is taken from the groves about April 1, it is not turned back again until the following December. From April to December the sewage is used in the open fields. At times during haying or walnut picking when all of the farm help is needed to care for the crops, neighbors take the sewage on their own farms.

Whether being used in the groves or in the open fields, the sewage is not allowed to run upon any one area longer than from four to 10 days at a time, after which period it is turned upon another area, and as soon as the area upon which it had been running is sufficiently dry to be worked, which is usually within two or three days, it is thoroughly cultivated or plowed. Frequently the top surface is plowed under, but this is not done after every period of irrigation, as only thorough stirring with a cultivator is necessary. The number of days that the sewage can be allowed to run upon a given area at any one period depends upon the weather and atmospheric conditions. If the weather is hot and dry, the period reaches its maximum, but if the weather is damp, when such odors as are present cannot rise readily but are held down close to the surface of the ground, the period is the minimum.

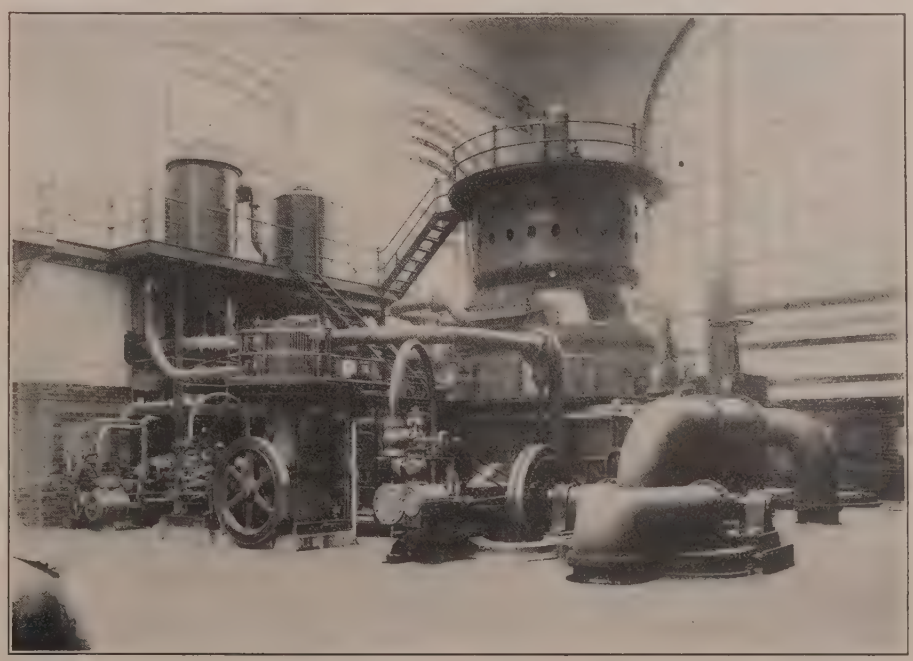
The first secret of the farm's success from a sanitary standpoint is the abundant sunshine and the dry climate of the locality, while the second secret is the thorough and constant cultivation to which the irrigated lands are subjected, which, combined with the first, with a faithful, enthusiastic and intelligent superintendent in charge, are productive of results highly satisfactory to the experienced sanitarian, and surprising to those who have given but little or no thought to this method of disposal. There are times, which are not frequent, when great care must be exercised to prevent conditions that are unsatisfactory in the immediate proximity of an area that is being irrigated. Usually one can approach the streams and stand upon their very edge without realizing that they are sewage. In the early morning, when the night sewage is being discharged, the flow is frequently perfectly clear. Later in the day it is discolored and has a soapy appearance.

At the entrance to the farm a settling tank is located, where the very coarse materials, which but seldom are more than rags, are caught and taken out. The most noticable solids, other than rags, which on account of their lightness at times collect on the surface where the flow is temporarily retarded, are coffee grounds and cork.

During the summer months, and even during the past few winters when the rainfall has been less than normal, the sewage has required no attention at night. One caretaker has succeeded in so arranging the flow during the day that his attention has not been necessary during the night. During those winters when the rainfall is above normal, the soil becomes more fully saturated from the rainfall, and therefore diminished in its sewer absorbing value, besides the flow is materially increased by some storm water which cannot be prevented from entering the various manholes. The time is near at hand on account of the rapidly increasing quantity of sewage, when a night caretaker will be necessary during all the winter months.

On account of the rapid growth of the city with the correspondingly increasing quantity of sewage, and the probability of an extremely wet winter when some difficulty might be experienced in keeping the sewage on the farm, it was decided to purchase 160 acres adjoining the original 300 acres on the north, while there was an opportunity to purchase the same. This tract was purchased about four months ago at $150 per acre, $12,000 of this has been paid, and the city assumed a $12,000 mortgage which was against the property. The entire $24,000 is being paid from the profits of the farm without bond issue or tax levy.

Electrically Operated Reclaiming Bridge in the Coal Storage.



Five-Thousand-Kilowatt Turbo-Generator and Auxiliaries, Edison Electric Illuminating Co.

There were raised on the farm this season 56,625 lb. of walnuts, sold at 11 cents per pound; 304 tons of hay worth $15 per ton; 1,500 bushels of corn worth $1.35 per hundred, and 275 tons of pumpkins selling at $2.50 per ton at the farm. The farm furnishes the hay used for the horses of the Fire and Street Departments, and the remainder is sold.

Some hogs are raised, which are turned into the fields of growing barley and sugar cane until fattening time and then fed on corn and pumpkins. Horse raising is expected to be undertaken whereby some of the horses for the Fire and Street Departments will be furnished. A field will be set apart for raising flowers, many of which will be used for the annual Tournament of Roses on New Year's Day.

Nothing is raised used for human food, that could in any possible way come in contact with the raw sewage.

Much credit is due to the various superintendents and city officials who from time to time have taken great interest in the farm's management. For its inception and successful beginning no doubt more credit is due to Prof. M. M. Parker of Pasadena, then a member of the City Board of Trustees, than to anyone else.

The sewers constructed since Jan. 1, 1900 (including sewers in the city, east-side outfall and at sewer farm) aggregate 42.47 miles. There are 650 manholes and 176 flush tanks. There are 3,166 connections in the city and about 40 in Alhambra. The manholes average about 450 ft. apart, and there is a flush tank at the head of every line with a capacity of 400 gal., and provided with a Miller siphon, about four-fifths of which are of the Potter design. It is not amiss at this time to mention that the Miller flush tank, which is being so widely used by American cities, was invented and patented in Pasadena by Mr. Miller, who at the time was employed in the city engineer's office, and was assisting upon the construction of the outfall and other sewers.

The quantity of sewage now being discharged ranges from 0.6 cu. ft. per second minimum, at about 7 o'clock a. m., to 2.0 cu. ft. per second maximum, at about 11 o'clock a. m., the average being approximately 1.3 cu. ft. per second.

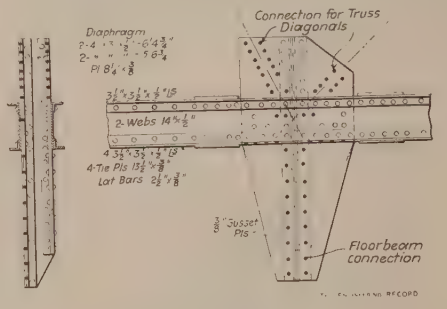
It is the writer's belief that in the arid west, where water is so valuable and the water plane is constantly lowering more and more rapidly as the quantity used increases, that to dispose of the sewage by piping it to the ocean by nearby cities, unless they be coast cities, is a needless and expensive waste. We realize that where the quantity of sewage is extremely large and the ocean can be reached, that an outfall thereto is necessary to take care of the winter sewage, unless very large farms are owned. From our experience in Pasadena it appears evident that the value of the sewage of any city in an arid country is only less than the value of irrigating water to the extent that the location in which, and the crops for which, it can be properly used are more limited; while on the other hand, for such crops as it can be properly used with, it has a greater value than irrigating water to the extent of its fertilizing value.

The Level of Lake Michigan at Milwaukee appears to be gradually lowering, if the records for twenty years, which were given in the last annual report of Mr. Charles J. Poetsch, city engineer, are taken as an indication. Daily records of the stage of the water in the lake were first made during the year 1884, at which time the mean height was 1.56 ft. above city datum. Since that time the level has fallen, until in 1903 the mean stage of water throughout the year was 0.66 ft. below city datum.

An Improved Detail for Lateral Connections.

In many of the older railroad bridges ample provision was made for the stresses from the horizontal lateral diagonals in the body of the transverse and longitudinal members of the system and for the transmission through the piers or towers to the substructure where all such forces must be absorbed, but in many cases there was inadequate provision made for transferring the concentrated stresses in the connections between longitudinal and transverse girders. Often these members had abundant section to resist transverse strain in the body of the member which disappeared for a short distance at the ends where the connection was made, and afforded a very weak point where the stresses were resisted only by the bending strength of comparatively thin plates. This was found in some instances to develop weak places, limiting the strength and durability of the whole structure and affording opportunities for the commencement of failure.

Cases are to be seen in some old railroad work where the longitudinal girders or stringers are web-connected to transverse girders or floorbeams by means of the usual pairs of vertical angles which, however, are not made the full depth of the girder, but are cut to clear the vertical legs of the top and bottom flange angles. Where this is the case and the lateral diagonals are connected to the longitudinal girders through either the top or bottom flanges or both,



Intermediate Floorbeam Connection.

it is evident that a very severe stress is developed which tends to shear the web through a horizontal line between the tops of the connection angles and the girder flanges. Such failures have frequently been observed in bridges of this type, and have sometimes progressed so far as to create a dangerous injury to the structure. A similar case is that of a deck riveted truss span about twenty-one years old which was designed for an important eastern railroad, and was in most respects excellently detailed and considered an example of high-class work. Here the vertical posts had a cruciform cross-section composed of two pairs of angles back to back engaging extended sections of the top-chord web-plates which formed connections for the diagonal members of the truss. The angles were separated so that clearance was left between the outstanding flanges of the inner pair to receive the web of the floorbeam which was field-riveted between them. In order to facilitate this connection the top and bottom flanges of the floorbeams were cut off a few inches shorter than the web-plate at each end to clear the continuous angles of the vertical posts. The lateral diagonal rods were pin-connected to the upper part of the floorbeams, and the resultant longitudinal stresses could only pass from the floorbeam to the truss through the comparatively thin web of the floorbeam which was not stiffened to resist transverse stresses beyond the ends of the flange angles. This connection was concealed so as to be inaccessible to ordinary inspection, and it was discovered only by accident that failure in the web had commenced. Repairs were immediately made, and it was found that in some cases the web was sheared across in a line running downward from the end of the top flange angles and through the line of the connection rivets. An accident was thus averted, whose occurrence would have been due to no lack of diligence of the inspector, for the fault was out of sight.

Another feature in which many otherwise well-designed bridges are conspicuously deficient is in the connection of the web members to the lower chords in riveted through trusses. Here the connection is ordinarily made with pairs of vertical jaw-plates riveted to the lower chord webs and engaging the vertical and diagonal members. Even where there is a vertical member it may not be carried through to the lower side of the bottom chord, and where there is no vertical member if the bottom chord is stiffened by a vertical transverse diaphragm, the latter is generally made of the same depth as the lower chord. This construction, although made with thick plates and providing ample tensile or compressive strength, depends, for its lateral stiffness only, on the rigidity of the plate itself at the point just above the upper edge of the bottom chord. It is obvious that all of the top-lateral, vibration and sway-brace stresses not passing through the portals and end posts, must be transmitted to the lower-chord lateral system through the web members of the truss and these connection plates. Therefore, the latter have to resist the maximum moment of flexure induced by these stresses in the vertical and diagonal members and concentrate it at the lower chord. This stress, although probably seldom causing the absolute destruction of the truss, is unquestionably serious and injurious. In order to provide for it, riveted trusses for the Erie R. R. Co. have for some years been made with transverse diaphragms stiffening the lower chords at panel points and projecting some distance above them, so as to develop great transverse stiffness in the jaw-plates and prevent shearing stresses in them in a horizontal line at the upper edge of the lower chord.

This construction is illustrated in the accompanying detail of the floorbeam and lower-chord connections for a 134-ft., through, triple-intersection, riveted-truss, single-track span on the Cincinnati Division. The floorbeams are field-riveted to the inside gusset plates with their top flanges flush with the bottom flanges of the lower chords. The plates to which they are riveted, and corresponding plates on the opposite web of the bottom chords, are connected by vertical transverse diaphragms which extend beyond the top flange of the bottom chord to the upper edges of the connection plates, thus affording undiminished stiffness for any transverse stresses brought down by the diagonal members and transmitted to the lower lateral system through the plates. This improvement has been developed in accordance with a constant observation of old bridges and the examination of the effects of loading and service with a determined effort to exercise as much care with lateral as with vertical stresses.

This detail was designed by Mr. M. R. Strong, engineer of bridges of the Erie R. R., and built in 1899 by the Elmira Bridge Co.

Experiments with Submerged Coal, to determine the effect of the submergence under water on the calorific value, have of late been somewhat numerous. In May, 1903, "The Engineer," of London, says that five crates of coal, each holding 2 tons, were sunk at Portsmouth and a similar quantity placed at a coaling point in small heaps, covered with tarpaulins. Six months ago it was found that the submerged coal had greater calorific qualities.

The Extension of Riverside Drive, New York.

Riverside Drive, the wide New York boulevard along the Hudson from 72d St. to 135th St., was completed several years ago and is now being extended to 158th St. The extension has, as a rule, a 58-ft. carriage road, an 18-ft. bridle path and two 15-ft. sidewalks separated from the roadway and bridle path by 5-ft. strips of parking. The total width varies from 100 to 350 ft., the increased width being due to grass slopes between the driveway and the walks. The maximum grade of the carriage way is 2 per cent. In many places it is carried on a fill between rubble retaining walls on both sides, the river wall being faced with granite ashlar. They are generally made with a base width equal to half the height and have concrete footings on hard-pan, pile or rock foundations.

On the east the intersecting streets will be raised to the same grade, except in three cases, at 138th, 145th and 155th Sts., where the boulevard will be carried over them on granite arches of 40 and 50-ft. spans. The retaining walls have a cut-stone coping and parapet surmounted with granite posts and lamps, and cut-stone stairways are provided at the intersection of several cross streets. Public comfort houses are located at several places along the line.

Sewers, drains, mains and electric lines for the driveways and adjacent property are included in the work. The brick and pipe sewers are carried on a bench near the foot of the east retaining wall, which is widened for that purpose. The water mains are carried on a similar bench near the top of the same wall, and vitrified conduits for electric wires are buried under one edge of the roadway.

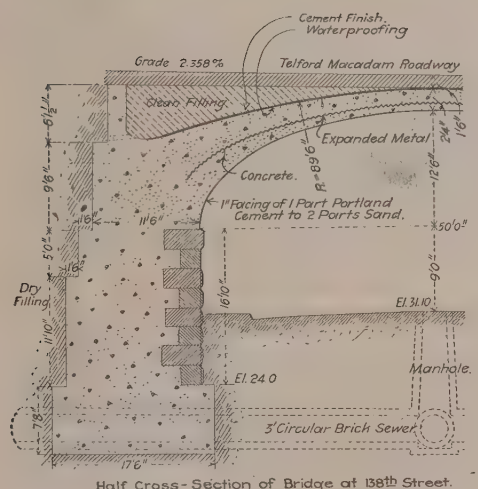
An unsuccessful effort was made to secure a width of 100 ft. along the western side of the Trinity Cemetery. Only 50 ft. of the cemetery land was secured and in order to maintain the minimum width of 100 ft. for the driveway at this point, it is carried on a steel viaduct with its center line on the west retaining wall and half of it projecting over the New York Central & Hudson River R. R. tracks about 60 ft. below for a length of about 700 ft.

The natural surface of the ground is not disturbed materially, except by trenching for the footings of the walls. The surface soil consists generally of a few feet of sand and loam overlying gneiss. The rock surface is very irregular and has frequent summits a few feet in width which rise 25 ft. above the adjacent rock surface, sometimes outcropping.

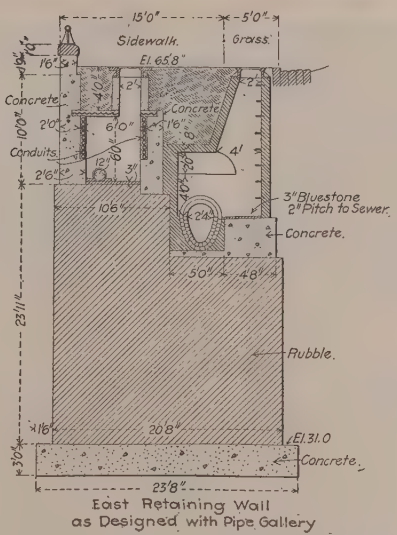
The west, or river, retaining wall has much greater dimensions than the other retaining wall. From 142d St. north to Audubon Park it is assumed that the adjacent property owners may build against the face of the wall, and it is made entirely of rubble masonry with a height of about 50 ft. above the ground. Elsewhere it is faced with heavy granite ashlar masonry with stones from 30 in. thick at the base to 15 in. at the top of the wall. A regular coursing is avoided and the stones are rock-faced. Weep holes 3 in. wide and extending the full depth of the course are left at frequent intervals and have their bottoms smoothly plastered. The backing is generally made in courses not more than 2 ft. high with stones not exceeding 20 cu. ft. in volume. From 140th to 142d Sts. the west retaining wall, which faces directly on the railroad tracks, has a height of 55 ft., and its footings are carried down to solid rock. Elsewhere the height of the west retaining wall is from 15 to 20 ft. At 140th St. its footings are built on hard-pan, and from 135th St. to 139th St. they are built on pile foundations. The center line of this wall was explored in advance with wash borings about 25 ft. apart, which were remarkable for the great irregularity in holes, the depth frequently varying from 5 to 30 ft. at adjacent points. The maximum depth of the trench is about 12 ft. below the surface of the adjacent railroad tracks. The piles in it are cut off 3 ft. below mean high tide, and about 1 ft. above the bottom of the trench.

The east retaining wall varies from about 20 to 50 ft. in height, and has a concrete footing about 3 ft. thick, which is carried down a few feet below the surface to a solid stratum of sand or gravel. A dry filling of broken stone is placed at the rear of all retaining walls and the earth fill is deposited on it in 6-in. layers, wet and tamped. Under the roadway the surface is consolidated with a 10-ton roller, and under the sidewalks there is built a concrete foundation to receive the asphalt or flagstones. All concrete for the footings is made with five parts 2-in. broken stone and one part of mortar, the mortar being composed of one part Lehigh Portland cement and three parts sand. The arches have cut granite face voussoirs and facing for the spandrel walls. The body of the arch is of 1:2:4 concrete made with Lehigh Portland cement and 1¼-in. broken stone. The exposed surfaces of the concrete are faced with 1 in. of 1:2 cement mortar, which is deposited with the concrete. The arches are reinforced by sheets of expanded metal embedded in the arch ring about one-third of the way from the intrados to the extrados. The arch is covered with a felt and asphalt waterproofing on which the ballast and roadway is built. A feature of the original design for the east wall was the construction of a pipe gallery in the upper part to afford access to the pipes and conduits as is shown in the typical cross-section. The Corporation Counsel rendered an opinion that there be built, and it was omitted and the top of the be built, and was omitted and the top of the wall constructed like that of the west wall.

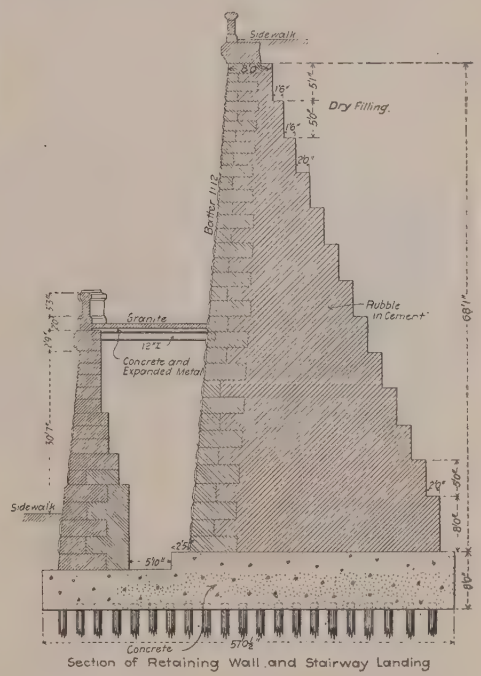
The plans were made and the work is directed by Mr. F. Stuart Williamson, consulting engineer. Mr. William Tyson Gooch has assisted in the architectural features, Mr. A. L. Webster has been consulted for the drainage and water systems, and Mr. John S. Griggs, Jr., for the electric lighting. The general contractors are the Ryan-Parker Construction Co. and J. C. Rodgers & Son. The contract for the steel viaduct adjacent to Trinity Cemetery has been awarded to the McClintic-Marshall Construction Co.



Half Cross-Section of Bridge at 138th Street.



East Retaining Wall as Designed with Pipe Gallery



Section of Retaining Wall and Stairway Landing

General Features of Arch and Retaining Walls on Riverside Drive, New York.

THE CENTRIFUGAL CIRCULATION PUMPS for the cooling water used by the surface condensers of the Ostre generating station, Copenhagen, according to "Elektrotechnische Zeitschrift," absorb 6 per cent. of the energy generated.

The Moline Bridge.

The bridge described in this article replaced an old county combination bridge across Rock River, near Moline, Ill., that had been in existence many years. The Government became interested in the construction of a new bridge by reason of its desire to utilize a stretch of the Rock River as part of the Illinois and Mississippi Canal, and an appropriation of $25,000 was made by Congress for building a bridge with sufficient head-room for the passage of such craft as navigate these waters, hence the peculiar form of structure with steep grades leading up to the channel span. Competitive designs were called for to fit the appropriation, and the design of the J. G. Wagner Co., since absorbed by the American Bridge Co., was finally accepted and the bridge was built by that company.

Mr. F. W. Moore was at that time chief engineer of the Wagner Co., and is responsible for the design of the bridge. With the exception of one new pier at the outer end of 124-ft. shore span, all the old substructure were utilized by being either repaired or rebuilt from water line up to bridge seats. All foundations are of first-class bridge masonry of stone from the LeClaire quaries, located ten miles north of Davenport, Iowa, on the bank of the Mississippi River. Stone was all cut at quaries and towed to bridge site on barges.

The new bridge is a riveted steel-truss through structure about 710 ft. long between centers of abutment seats, carries a roadway with a clear width of 18 ft. and has a maximum clear height of 35 ft. above the water in the middle of the river. The bridge is somewhat remarkable on account of the proportions and arrangements of the trusses. These are in four spans with three river piers, two of which occupy the same positions as former piers for an older structure. With the exception of a 124-ft. span at one end, the bridge is symmetrical about its center line and consists of two main side spans which are made continuous with two-panel cantilever arms projecting beyond the river piers to carry a suspended center span. The river ends of these spans are supported on rocker bents and their parallel top and bottom chords are inclined to the horizontal to nearly correspond with the 6 per cent. grade of the floor platform. This platform is carried practically midway between the top and bottom chords up to the ends of the cantilever arms. At these points it is united by flat vertical curves with the horizontal floor carried by the suspended center span which has horizontal top and bottom chords.

At one end of the bridge an additional shore span of 124 ft. is built with inclined chords and the river ends of the trusses are elevated on a rocker bent so as to keep the floor system close to the lower chord and still maintain it in the line of the middle adjacent trusses. This arrangement of trusses produces an unusual effect in the side elevation of the bridge and serves to secure a maximum center headway with a minimum elevation at the abutments, and with more simplicity and regularity of detail and therefore more economy in the superstructure than is usually secured for spans of such character or is indicated by the first glance at the general elevation.

The largest trusses are those for the side spans, 211 ft. 9 in. long, 30 ft. deep and 19½ ft. apart on centers. The peculiarities of position and loading make the stresses unequal in the symmetrical panels on opposite sides of the truss center. The top chord and end post are made with a pair of 12-in. channels and a 16-in. cover-plate throughout, the thickness of the plate and the weight of the channels being slightly modified to produce differences in cross-section. The maximum top-chord stress of 338,500 lb. obtains in four full panels and it only changes slightly in the two adjacent panels, all six panels being made with a uniform cross-section of about 18 sq. in. The maximum bottom-chord stress of 318,200 lb. obtains in the two center panels only and is provided for by four 6x3½x7/16-in. angles with 15 sq. in. net cross-section. Two full panels on each side of this section are made the same, excepting that the angles are ⅝ in. thick and the end panels are made with pairs of 7x3½-in. angles. The main vertical posts in the center of the span are made with pairs of 11-in. channels, latticed. All of the other truss members are made with pairs or double pairs of angles. The cantilever arms are extensions of the main truss and correspond to it, except that the lower chord is made of pairs of channels, latticed.

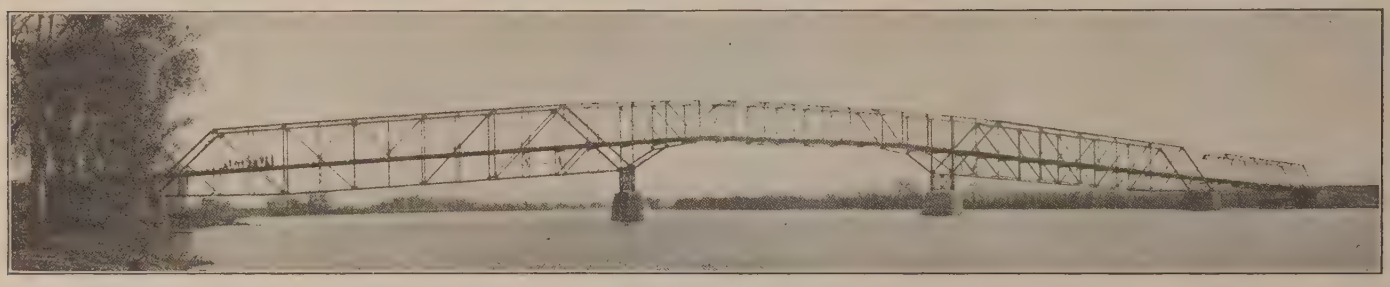
The center suspended span is 102 ft. 11½ in. long and 18 ft. deep and has a top chord made with pairs of 6-in. channels, a 10-in. cover-plate, a T-shape bottom chord made with pairs of 4x3 and 6x3½-in. angles, vertical posts made with four 3½x2½-in. angles and diagonals made with pairs of 2½x2½-in. angles. There are two lateral systems, the upper one consisting of transverse struts at panel points and X-bracing of single angles in every panel. The lower one consists of single X-brace angles in every panel between floorbeams. The top-lateral stresses are transmitted to the end posts by means of the ordinary lattice-girder portals and kneebraces at the ends of the suspended center span and side spans. Sway-bracing is provided by kneebraces at the ends of the top-lateral struts in all spans and by X-bracing of single angles between the vertical posts below floor level in the side spans.

The center suspended span was proportioned for a dead load of 580 lb. and a live load of 1,500 lb. per linear foot equal to 4,300 lb. and 11,000 lb. per truss per panel, respectively. The side spans were proportioned for dead and live loads of 840 and 1,500 lb. per linear foot equal to 6,400 and 11,400 lb. per truss per panel, respectively. The bridge was designed under Cooper's specifications for steel highway bridges and two cases were considered; where the whole bridge was loaded and where the side span only was loaded, the greater of the two stresses thus derived being used. These calculations gave a maximum dead and live-load reactions of 75,714 lb. and 148,230 lb., respectively, on the rocker bents at the center piers. At the shore ends of the side spans the maximum dead and live-load reactions were 38,535 lb. and 74,100 lb. respectively, and the minimum reaction was 31,200 lb. when the center span was fully loaded and the side spans were unloaded. This demonstrated that no up-lift was possible at this point and, therefore, no anchorages were provided.

The 211-ft. 9-in. side-span trusses have the top chords nearly parallel to the line of the floor grade and are peculiar in that the bottom chord is not parallel to the top chord throughout the entire length. For the first four panels at the shore end the chords are divergent so as to give the truss a depth of 28 ft. 2¼ in. center to center of chords at the hip and of 30 ft. at L-4 U-4, the latter dimension being constant for the remaining eight panels of the truss up to the hip joint U-12 at the river end. This peculiarity introduces a distinct bend in the bottom chord at point L-4 which is further accentuated by the change at this point from a cross-section composed of two pairs of 6x3½-in. angles in the center panels to one pair of 7x3½-in. angles in the end panels, thus making a difference of 1 in. in the vertical depth of the chord, although its horizontal width remains constant.

The details of the truss are very simple and the connections throughout correspond to those shown in the partial elevations here illustrated. Gusset plates are shop-riveted to the webs of both top and bottom chords and are field-riveted to all of the vertical and diagonal members of the trusses, which were shipped separately and assembled in the field, the top chord being made with splices at the hips and at two intermediate points and the bottom chord being spliced at three points. The top-chord splices are made for the webs with the regular gusset connection plates and for the flanges and cover-plates are made with top and bottom horizontal plates. The horizontal flanges of the bottom-chord angles are spliced by the connection plates for the lower laterals. The vertical flanges are spliced by special vertical plates riveted over the gusset connection plates.

At the shore ends of the trusses the vertical flanges of the pairs of angles forming the lower chord are turned upwards to serve as webs for the connection of the gusset plates. In the four panels at each end of the truss the 7-in. vertical flanges of the angles are spaced 9½ in. apart back to back and their 3½-in. horizontal flanges are connected by transverse tie plates. In the middle six panels of the span the four 6x3½-in. angles are riveted together in two pairs back to back with ¾-in. fillers between, the back of the outer angles of each pair being in the same planes as that of the single angle in the end panel. The horizontal bottom flanges of the lower-chord angles are connected by inter-



General View of Moline Bridge.

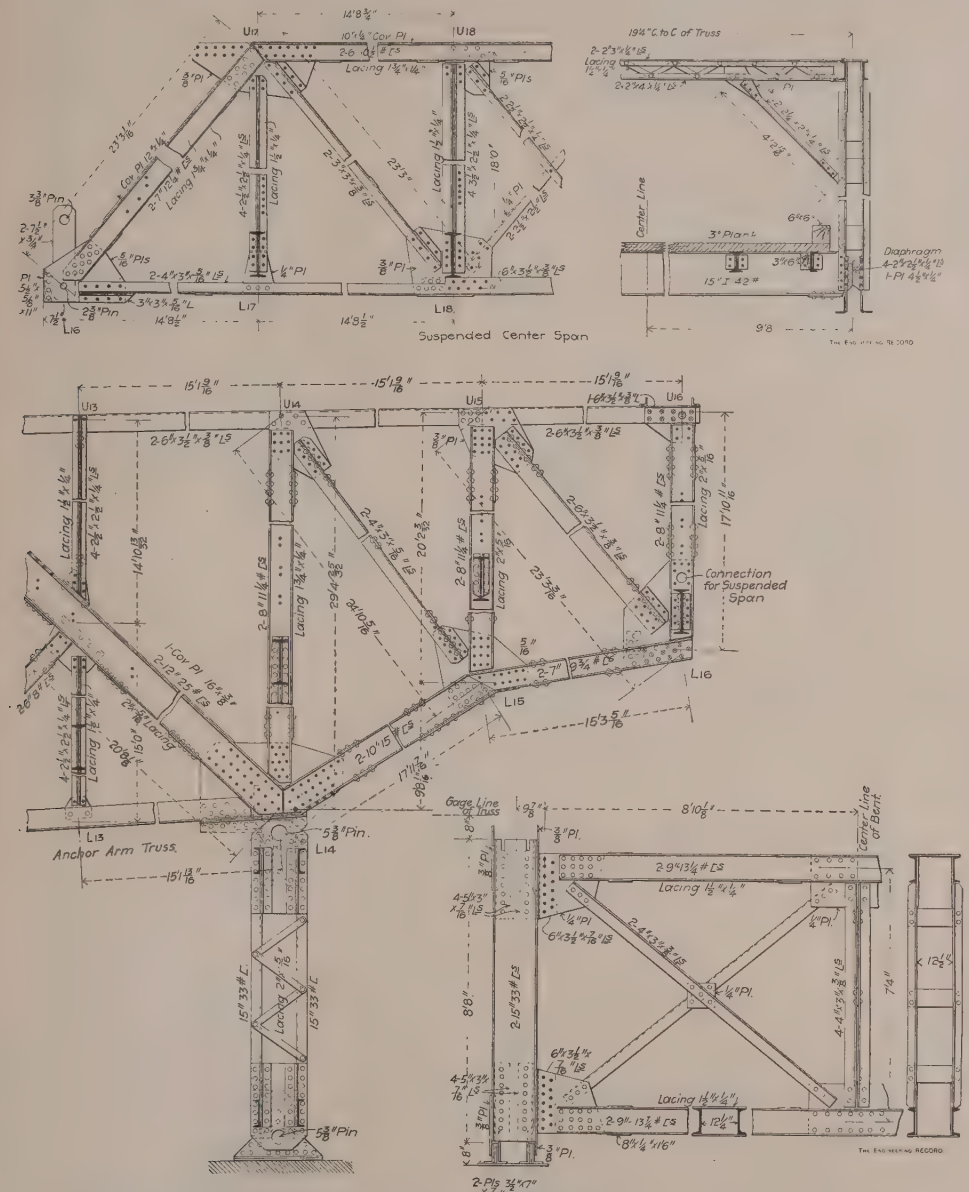
mediate narrow transverse tie-plates and by wide horizontal plates at panel and sub-panel points which project beyond the inner edges of the chords and receive the field-riveted connections for the lower-lateral struts and diagonals. Similar horizontal plates are riveted to the inner edge only of the cover-plate of the top chord and receive the connections for the top-lateral struts and diagonals.

The top-lateral struts at the main panel points all have I-shape cross-sections made with two pairs of 3x2-in. angles, latticed, and have a depth of 12⅜ in. corresponding to the depth over all of the top chord. The transverse struts at panel points U-13, 14, 15 and 16 of the cantilever arm are also made with four 3x2-in. angles in two pairs all riveted together back to back so as to have a cruciform cross-section at the ends where the upper and lower pairs are spaced far enough apart to form jaws engaging the horizontal plate connecting the lateral diagonals with the top chord. The upper and lower pairs are sprung apart 4 in. in the center and are connected by vertical tie plates. The bottom-lateral struts are made with four 2½x2-in. angles riveted together back to back to form a cruciform cross-section at the ends and sprung so that the two pairs are 4 in. apart vertically at the center.

The main vertical posts are composed of pairs of channels with their webs parallel to the planes of the trusses. Pairs of vertical angles are shop-riveted to them back to back with their outstanding flanges separated far enough to receive the webs of the 15-in. 42-lb. I-beam floorbeams which have their flanges cut to clear the connection angles and are field-riveted to them with five ¾-in. rivets. The vertical post is stiffened and the floor load is distributed between both its channels by a transverse vertical diaphragm opposite the end of the floorbeam. The sub-vertical posts are made with two pairs of 2½x2-in. angles back to back with their outstanding flanges separated sufficiently to receive the floorbeam webs which are field-riveted to them. The bottom-lateral struts correspond to the top-lateral struts at U-13, 14, 15 and 16. The lower-lateral diagonals are all single angles with their vertical flanges turned to clear at their intersections, where the horizontal flanges are riveted together with small connection plates. The ends of the angles have both flanges field-riveted to the connection plates on the lower chord by means of short angle-clips shop-riveted to the vertical flanges in the ordinary manner. The top-lateral stresses are carried to the pier masonry at the shore ends of the side spans and there is no portal bracing provided between the inclined posts at the river ends of these spans. The portals at the shore ends are of the ordinary lattice-girder type connecting the upper ends of the inclined posts at U-2 and are stiffened by kneebraces. Additional sway-bracing is provided between these end posts below the floor level by means of an upper and lower transverse strut, each having an I-shape cross-section made with a pair of 2½x2-in. angles riveted together back to back and latticed. These struts are riveted between the flanges of the end posts and the space between them is X-braced by a pair of screw-ended rods 1 in. in diameter with their nuts bearing on the ends of sleeve-plates riveted to the cover-plates of the end posts and enclosing the rods.

At the shore ends of the trusses wide ⅜-in. plates are riveted across the horizontal flanges of the bottom chord and project beyond them on the inside to receive the lateral strut and diagonal. These plates also serve as sole plates and are supported on the upper surfaces of the webbed cast-iron pedestals to which they are secured by six 1½-in. anchor bolts extending through into the masonry. At the river ends of the trusses pairs of angles are riveted to the under side of the lower chord at panel point L-14 and vertical web-plates are riveted to them and to the gusset connection plates so as to project below the chord and virtually form the webs of shoes integral with the trusses. These shoes have half-hole bearings for 5⅜-in. pins, and one plate in each web is extended far enough to have a full-hole bearing and lock the truss to the pin which engages the top of the rocker bent, and thus affords a movable support to provide for the temperature expansion and contraction. Beyond this joint the two panels of the cantilever truss are made continuous with the main truss and their details and connections correspond with those already described. The bottom chord of the cantilever arm is made with pairs of channels latticed on both flanges, and the top chord is made with a pair of angles having the vertical flanges turned down and the horizontal flanges turned in so that the former engage the inner faces of the channel webs in the top chords of the main trusses, to which they are field-riveted and thus form a connection transmitting the tension from the cantilever stresses through the rivets in shear at this point.

The 102-ft. 11½-in. center span has simple Pratt trusses with light stiff members having field-riveted connections throughout. The top chords have a standard trough-shape cross-section and were shipped in two pieces with a field-riveted splice just clear of the center panel-point connections. The bottom chords each have two splices at panel points L-18 where the angles change from 4x3 to 6x3½ in. The vertical members were all made with two pairs of angles back to back, receiving between them the field-riveted connection of the floorbeam webs similar to the floorbeam connection with the sub-verticals of the side spans. The top and bottom chords are horizontal and all of the floorbeams are at the same level. The lower-lateral diagonals are connected to horizontal plates on the bottom flanges of the floorbeams and have no direct connection to the lower chords. The top laterals and top transverse

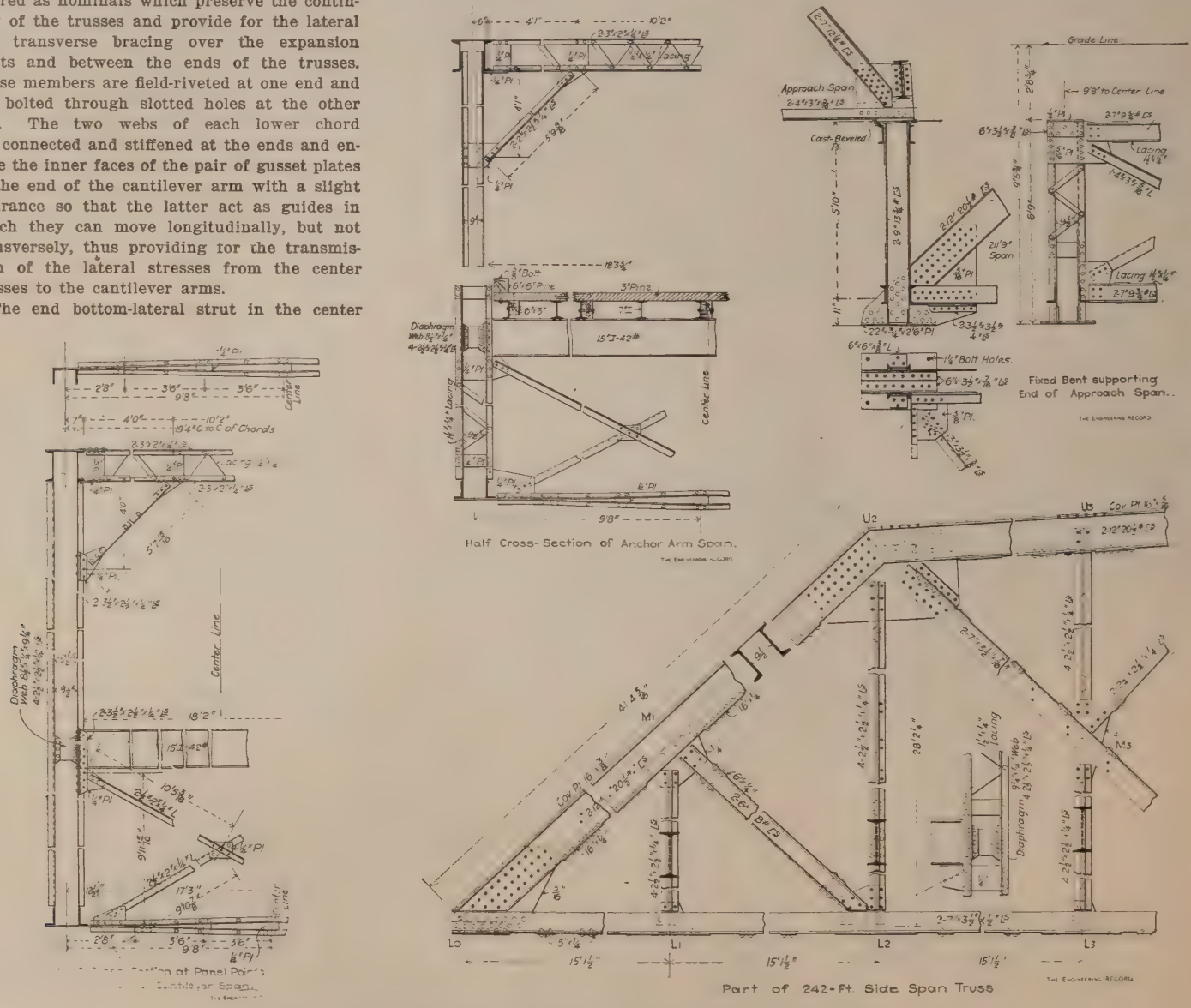

Suspended Center Span
Connection for Suspended Span
Anchor Arm Truss
Cantilever Arm and Connected Panel of Anchor Arm and Supporting Rocker Bent.

Part of Cantilever and Anchor Arms, Rocker Bent and Suspended Span.

struts correspond with those in the side spans as do the portal braces at U-17, which, however, are lighter and smaller than those at U-2. The suspension of this span is not merely nominal, but it is supported entirely by means of a pair of 7½x¾-in. vertical links made of plates which engage at their lower ends the 2-in. pins through the lower chords and at their upper ends engage the 3⅝-in. pins in the extremities of the cantilever arms. This connection enables the ends of the lower chords to enter between the webs of the vertical end posts in the cantilever arms opposite the ends of the floorbeams at L-16 which are carried by the cantilever arms. The entire dead and live loads from the center span are carried through these links and the top-chord members U-15 U-17 are considered as nominals which preserve the continuity of the trusses and provide for the lateral and transverse bracing over the expansion joints and between the ends of the trusses. These members are field-riveted at one end and are bolted through slotted holes at the other end. The two webs of each lower chord are connected and stiffened at the ends and engage the inner faces of the pair of gusset plates at the end of the cantilever arm with a slight clearance so that the latter act as guides in which they can move longitudinally, but not transversely, thus providing for the transmission of the lateral stresses from the center trusses to the cantilever arms.

The end bottom-lateral strut in the center span just clears the end of the cantilever arms and there is a special end bottom-lateral strut in the cantilever truss which is composed of a 7-in. I-beam with horizontal web riveted to the end lower-chord connection plates 18 in. in the clear from the center span strut. The floorbeam L-16 at the end of the cantilever arm has field-riveted web connections for the stringers on the shore side and on the river side has wide angle-bracket shelves on which the stringers for the center span are seated. These shelves are made with horizontal 6x6-in. angles and vertical 5x3-in. angles with the 5-in. leg outstanding and milled to support the horizontal flange of the 6-in. angle. The horizontal flanges of the 6-in. angles have 11/16x2½-in. slotted holes for the connection bolts in the lower flanges of the stringers and thus provide for temperature movements.

The side spans and cantilever arms are supported on the river piers by rocker bents at L-14. Each bent consists of a pair of vertical posts connected by transverse top and bottom struts having a middle vertical member and two panels of X-bracing. The vertical posts have top and bottom diaphragms opposite the X-brace connections. They have 5⅜-in. pins at the top and the bottom, the former engaging the shoe on the lower chord of the truss and the latter engaging an ordinary double-web riveted pedestal bolted to the masonry.


Half Cross-Section of Anchor Arm Span.
Fixed Bent supporting End of Approach Span.
Part of 242-Ft. Side Span Truss
Part of Cantilever Span.

Part of Side Span and Bent Supporting Approach Span, Moline Bridge.

The 124-ft. end span has the top and bottom chords inclined parallel to the 6 per cent. grade of the floor and is made with riveted trusses 20 ft. deep which correspond essentially to those of the center span. At the abutment end a horizontal cast-iron sole plate 1 11/16 in. thick is riveted across the lower chord and is bevelled to correspond with the grade. It is seated on a nest of five 2⅞-in. rollers 17 in. long over all that are engaged between the vertical flanges of 3x4-in. angles riveted across a ¾-in. bedplate which is secured to the masonry with four 1¼-in. anchor bolts. At the opposite ends of the trusses ½-in. sole plates are riveted across the bottom chords and are seated on the caps of a pair of vertical posts nearly 7 ft. high. These posts are braced together with top and bottom transverse struts and two panels of X-bracing so as to form a rigid transverse bent. The lower ends of the post have wide base plates stiffened by vertical gussets and seated on the masonry so as to provide a rigid fixed bearing for the superstructure.

Fires Due to Electricity.

Fires attributable to electricity in New York City during 1904 number 26, according to the Electrical Department of the Board of Fire Underwriters. Half of these fires were caused by a defective condition of electric equipments and caused a loss of $5,610. The total loss from the 26 fires was $16,770. Eleven fires were due to grounding of conductors against gas pipes, caused principally by deterioration of the insulation; three to short circuiting of conductors, two to the use of bell circuits on the electric light system, one to poor contact on a knife switch, two to grounding of conductors owing to dampness, three to heat from incandescent lamps igniting inflammable material, one to overheated flat iron, two to short circuits on flexible cord, owing to improper use of this material, one to the ignition of a barrel of paint by sparks from generator.

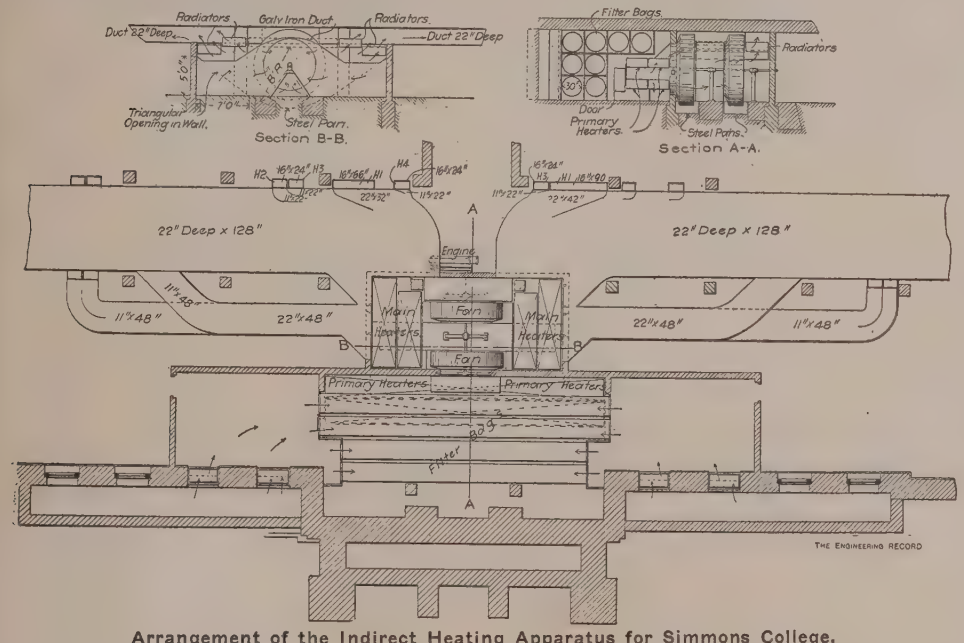
The Mechanical Plant of Simmons College, Boston.

By K. S. Howard.

An interesting mechanical plant was recently placed in service in Boston by the opening of the new building of Simmons College on Ruggles St., Back Bay Fens. The college is one of the younger institutions of Boston, having been chartered in 1899 for the purpose of instructing women in such branches of art, science and industry as would best enable them to earn an independent livelihood. The new building is an outcome of the need of increased facilities to meet the demands of a rapidly growing institution, and it consists of a gray mottled brick and steel four-story and basement fireproof structure, divided into a main portion 172 ft. long and 81 ft. wide, and flanked by two wings projecting one on either side, 88 ft. long and 34 ft. wide each. The total frontage is 240 ft. and the ground area 19,000 sq. ft. A copper belvedere containing the ventilation outlets surmounts the center.

The mechanical plant takes care of the heating, ventilating, lighting and power supply required by the college and is located in the basement, which is also devoted to storage and repair shop purposes. A temporary cloak room and a lunch room are also located in the basement. The wings furnish six laboratories, those for physics and typewriting being on the first floor, biology and chemistry on the second, and cooking and library practice on the third. In the central portion, there are found on the first floor two lecture rooms, one for physics and chemistry and the other for general lectures, with inclined floors. An apparatus room, class rooms and offices of instructors are also located on this floor. On the second floor are the general office, private offices, class rooms, and laboratories, while the third floor is given up to the department of household economics, class rooms and offices. The upper floor, which is built over the central portion only, contains the library and an assembly hall. Messrs. Peabody & Stearns, of Boston, were the architects and Mr. Arthur C. Whitney the builder.

The building is heated by both mechanical draft and direct radiation. Steam is supplied from two Heine water-tube boilers rated at 169 h.p. each, containing a total combined heating surface of 3,370 sq. ft. Each boiler is fitted with a New England roller grate 7 ft. 4 in. by 6 ft. in length and width, and is built to carry 160 lb. working pressure. The present maximum is 80 lb. The setting of each boiler is of brick, and Baltimore smoke consumers are installed. A hydrostatic test of 225 lb. was applied to the boilers. City water and the returns of the heating system are used in the boilers. The coal used is half buckwheat and half Cumberland, hand firing, of course, being employed. The coal is weighed regularly. The stack is 80 ft. high and is of elliptical section in order to fit inside the brick ventilating shaft which surrounds it. The diameters of the section are 42 in. and 96 in. The first 50 ft. are built of ½-in. steel plates, and the rest of ⅜-in. plates. The smokepipe is built of No. 10 steel. A Spencer damper regulator is installed, and the boilers are equipped with a single 36x60-in. blow-off tank. There are two 7½x4½x6-in. Warren feed pumps, duplex and brass fitted. All the feed water piping is of brass. The pump exhaust steam is discharged into the heating system through a 2-in. Webster oil separator. Live steam for the heating system is supplied through a Waters reducing valve with a 3-in. bypass. The steam pressure seldom exceeds 2½ to 3 lb. The laboratories are also supplied with low-pressure steam through a reducing valve, for experimental purposes.



Arrangement of the Indirect Heating Apparatus for Simmons College.

The air supply for the ventilation of the building is drawn in from out-of-doors through four openings, each 8 ft. 2 in. by 4 ft. 9 in. in size. These openings are equipped with adjustable louvres of iron painted with asphaltum. The air then passes through eight cheesecloth filter bags, thence through coils of steam pipe for primary and secondary heating. The filter bags are each 30 in. in diameter and 36 ft. long, and they are adjustable for shrinkage in washing. From the secondary heating coils the air passes into a main duct which runs the entire length of the building. From this duct branches are taken off for the different floors and rooms. The hot-air system contains 7,240 sq. ft. of indirect surface. The Johnson automatic system of temperature control is installed, together with a system of humidifiers and humidostats which is comparatively new in Boston.

There are two humidostats, consisting each of a strip of maple cut crossways of the grain and fastened so that its swelling or contraction on the absorption or rejection of atmospheric moisture operates a pneumatic needle valve which in turn controls the steam supply of the humidifier. The latter consists mainly of a perforated steam pipe wound with tallow candle wicking. Moist steam is injected into the air supply in the main duct automatically by this apparatus. The compressed air supply for the above apparatus is derived from two hydraulically operated air pumps. The dampers in the fresh air supply to the halls may be closed by compressed air from the boiler rooms, the same arrangement being installed in the ventilator dampers in the belvedere. The apparatus is controlled by three way cocks. The steam supply valves for the primary heaters are controlled in the same way.

The air is drawn into the building by two direct-connected 9-ft. Sturtevant fans, chain driven from a 10x10 in. center-cramp engine at 260 r.p.m. The direct radiating system has 5,508 sq. ft. of surface, the majority of this radiation consisting of coils of 40-ft. of 1½-in. brass pipe. All direct radiation, except that in corridors and toilet rooms, is under the control of thermostats located in each room. The registers are of the lattice pattern, operated by keys, to prevent tampering. The heating and ventilating ducts are of galvanized iron, with the exception of the discharge from the chemical department. Tile ducts are used in the flues of this department, the attic joints being made of 1-in. slate screwed with cemented joints, on account of the effect of acid fumes upon metal ducts. Anderson traps are used throughout the piping system.

The chemical laboratories are vented by a 42-in. exhaust fan driven by a 1-h.p. 110-volt motor, and by a 30-in. fan propelled by a ½-h.p. motor. A 2-h.p. motor drives a 60-in. Sturtevant fan in the tower which vents the toilet rooms. The science lecture room table is fitted with a grating through which fumes are exhausted into a duct and drawn away by a ⅓-h.p. motor, so that the most trying experiments with chlorine and other penetrating gases can be carried on with little discomfort.

In the summer, water is heated by a 16-in. cast-iron Ideal heater located in the boiler room. A No. 4 Hancock ejector, which can be operated by either steam or water, is installed in the boiler room in connection with a sump pit. Messrs. Lynch & Woodward, of Boston, were the contractors for heating and ventilating.

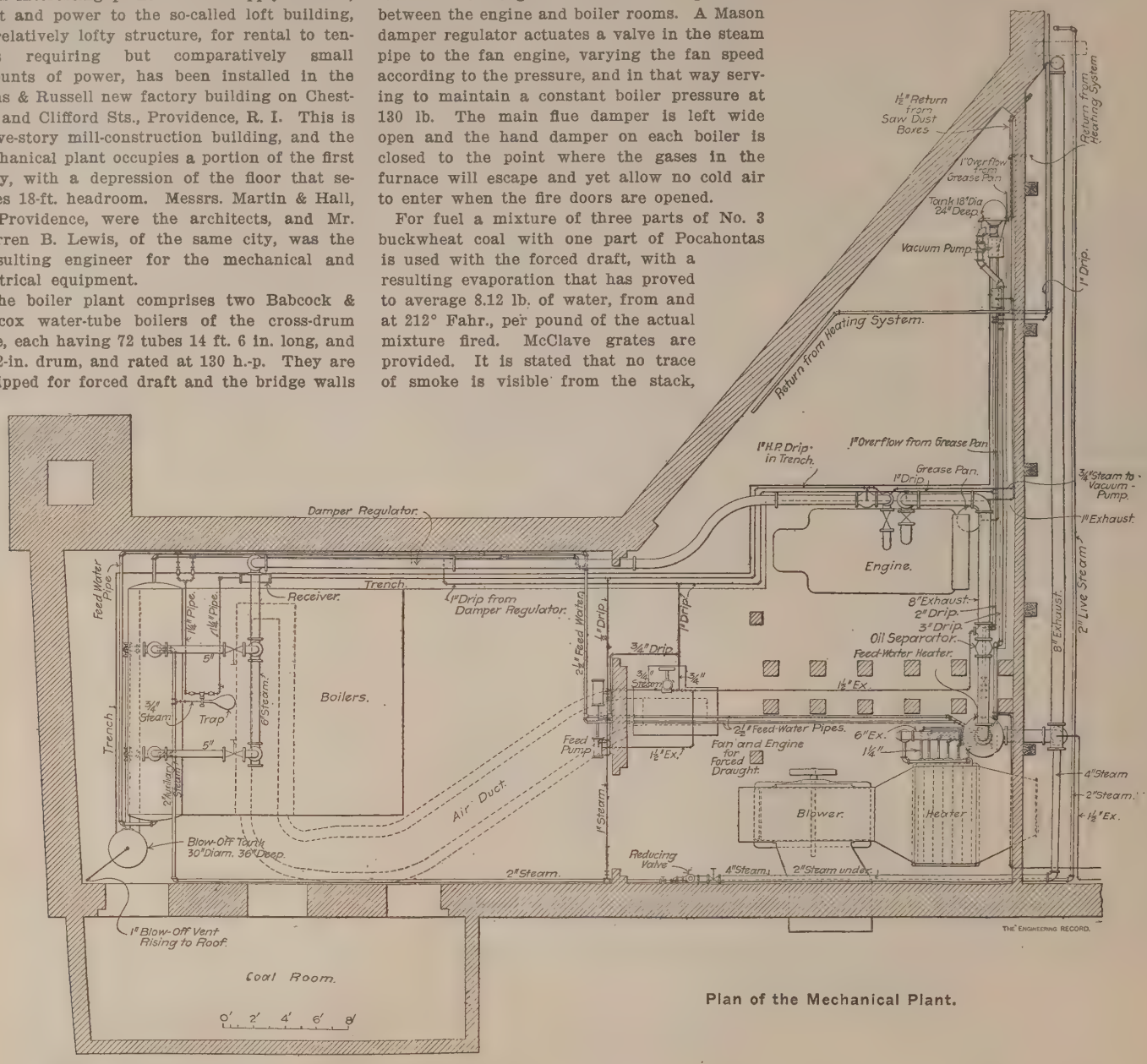
At present the electrical supply for the building is taken from the mains of the Boston Edison Electric Illuminating Co., but arrangements can easily be made whereby an isolated electric plant may be installed in the basement. The lighting load consists of about 1,400 16-c.p. incandescent lamps operated on a three-wire 110-volt alternating-current system of distributing circuits. About 60 G. E. Meridian lamps are installed on trial in the basement. The controlling switchboard of the electrical system is located in a special basement room. It is 10 ft. 6 in. long and 6 ft. high, and is made of Monson slate. A Whittier passenger-freight electric elevator is installed, operated by a 12-h.p. 500-volt motor. Current for the 110-volt fan motors mentioned is drawn from a 4.5 kw. motor generator set working at 1,650 r.p.m. Compressed air for cleaning and for experimental purposes in the laboratories is obtained from a 500-volt motor-driven compressor. Both direct and alternating currents at 110 volts are brought to terminals in the laboratories for experimental purposes, pilot lamps being provided to show when the current is left on. Iron-armored conduit is installed throughout. The college is equipped with intercommunicating telephones, a watchman's clock system, the Blodgett programme clock system, fire extinguishers, and a complete system of call bells. The Lord Electric Co., of Boston installed the electrical equipment, and the superintendent of the building is Mr. W. P. Boyd. Dr. Henry Lefavour is president of the college.

Mechanical Plant of a Power Building in Providence, R. I.

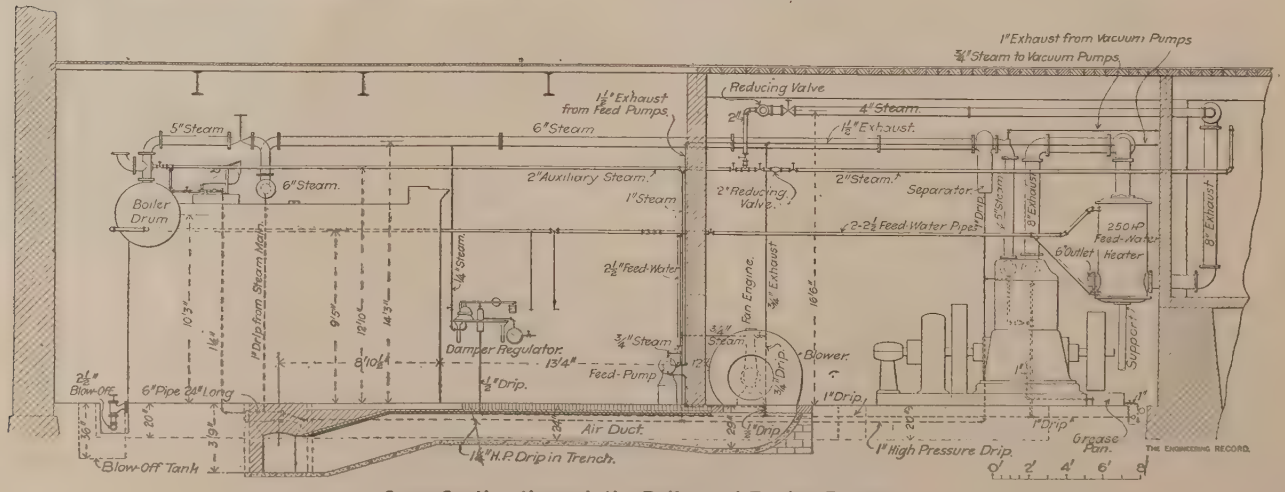
An interesting plant for the supply of heat, light and power to the so-called loft building, or relatively lofty structure, for rental to tenants requiring but comparatively small amounts of power, has been installed in the Irons & Russell new factory building on Chestnut and Clifford Sts., Providence, R. I. This is a five-story mill-construction building, and the mechanical plant occupies a portion of the first story, with a depression of the floor that secures 13-ft. headroom. Messrs. Martin & Hall, of Providence, were the architects, and Mr. Warren B. Lewis, of the same city, was the consulting engineer for the mechanical and electrical equipment.

The boiler plant comprises two Babcock & Wilcox water-tube boilers of the cross-drum type, each having 72 tubes 14 ft. 6 in. long, and a 42-in. drum, and rated at 130 h.-p. They are equipped for forced draft and the bridge walls are hollow and built over the air duct. Blast gates are set in the bridge wall, and the rods for opening and closing them lead through the boiler fronts. A 70-in. Sturtevant steel-plate fan, driven by a single-cylinder vertical engine, furnishes the air for the forced draft. This, as indicated in the accompanying plan, is located on the engine-room side of the partition between the engine and boiler rooms. A Mason damper regulator actuates a valve in the steam pipe to the fan engine, varying the fan speed according to the pressure, and in that way serving to maintain a constant boiler pressure at 130 lb. The main flue damper is left wide open and the hand damper on each boiler is closed to the point where the gases in the furnace will escape and yet allow no cold air to enter when the fire doors are opened.

For fuel a mixture of three parts of No. 3 buckwheat coal with one part of Pocahontas is used with the forced draft, with a resulting evaporation that has proved to average 8.12 lb. of water, from and at 212° Fahr., per pound of the actual mixture fired. McClave grates are provided. It is stated that no trace of smoke is visible from the stack, which is carried up through the building and is of sufficient proportions to supply natural draft under ordinary conditions. The Pocahontas coal costs $3.40 per ton of 2,200 lb. in Providence, delivered, and the buckwheat $2.60, making the cost per ton of the mixture, $2.80. The feed pump, in the boiler room under the direct control of the fireman, is a Mason 7x5x12-in. single pump. The water is delivered through a 250-h.-p. feed-water heater, with 83 sq. ft. heating surface, built by the National Pipe Bending Co., of New



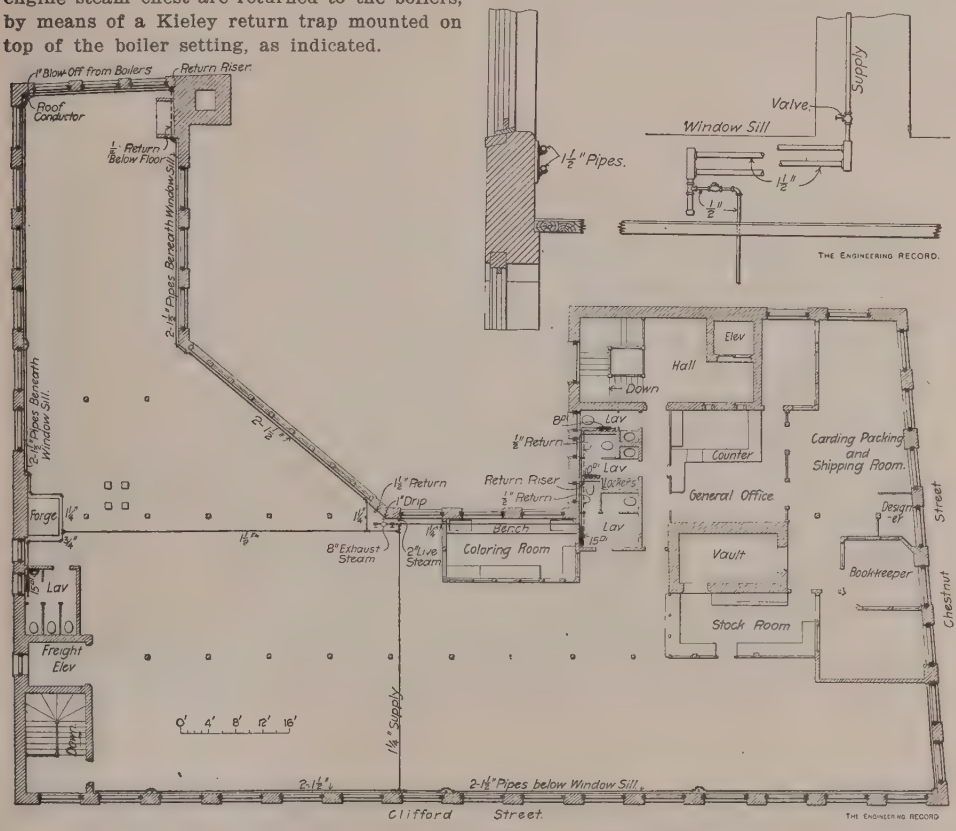
Plan of the Mechanical Plant.



Cross-Section through the Boiler and Engine Rooms.

Haven, Conn., and enters the boilers at 210°.

The generating plant is comprised in one unit consisting of a 12 and 20x12-in. Westinghouse vertical compound engine direct-connected to a 75-kw. 500-volt Crocker-Wheeler direct-current dynamo. The running speed of the unit is 270 r.p.m. The results of tests of the engine, when exhausting into a surface condenser at atmospheric pressure and weighing the condensation, are as follows, no allowance being made for condensation in pipes to the engine: Initial pressure, 130 lb.; when the load was 153.1 i.h.p., the water rate per indicated-horse-power-hour was 21.7 lb.; when the load was 89.8 i.h.p., or 60 per cent. of rating, the water rate was 22.6 lb. The location of the machinery and the run of the piping is shown in the illustrations. A Cochrane separator, made by the Harrison Safety Boiler Works, is provided in the steam supply to the engine, immediately outside of the steam downtake to the engine, and the water from this and the drainage from the high-pressure piping and engine steam chest are returned to the boilers, by means of a Kieley return trap mounted on top of the boiler setting, as indicated.



Plan and Details of Direct Radiation on the Fifth Floor.

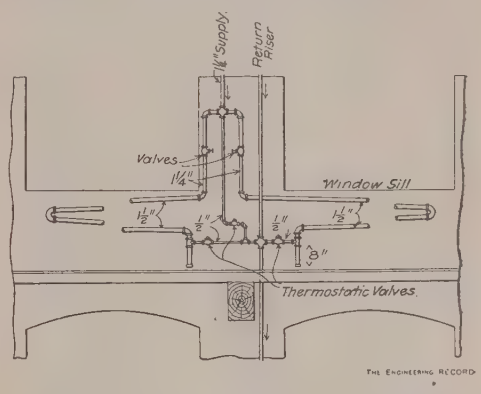
The exhaust is piped through a Cochrane oil separator into the feed-water heater, entering the latter at the top. All the exhaust from pumps and engines is led into the main pipe and all must pass through the feed heater, which has two outlets at the bottom. One of these supplies exhaust steam to the adjacent Sturtevant fan-heater unit, which furnishes the greater part of the heat to the building; and the other, at the full size of the exhaust main, is carried upward through the building, supplying direct radiation on each floor and reaching the atmosphere through an exhaust head, with a semi-balanced Kieley relief or back-pressure valve below it for use during the heating season.

The fan for the heating system is driven by a 10-h.-p. electric motor with speed regulation giving speeds varying from 100 to 220 r.p.m. on the fan wheel. At the maximum speed the fan is counted on to deliver 40,000 cu. ft. of air per minute, the fan wheel being about 7 ft. in diameter; and there are about 1,250 sq. ft. of heating surface in the heating coils, in five four-row and one two-row sections. The warm air is led through an underground duct to two vertical shafts and is distributed on each floor through galvanized-iron pipes. The fan system is depended on altogether for the offices arranged along the Chestnut St. front of the building, while it is supplemented on the rest of each floor by direct radiation. It is designed to effect six changes of air an hour in the front portion of the building, and four changes in the rear.

The entire heating system is circulated under the action of a vacuum pump with Webster thermostatic valves on the return connections The direct radiation is largely in the form of two-pipe coils extending along the outside walls underneath the windows, and the typical arrangement of connections to the direct radiation is shown in accompanying engravings. The drips from the heating surface and the drip from each section of the indirect heater are led to the vacuum pump, at which a vacuum of about 8 in. is carried. On cold days all the exhaust is condensed in the heating system and some live steam is added through a reducing valve. The auxiliary supply of live steam is obtained from an auxiliary steam main, as shown, and a live steam line at boiler pressure is carried alongside the exhaust heating riser, with an outlet at each floor for such tenants as desire such steam. Similarly, the exhaust riser has two outlets on each floor, one connecting into the distributing lines for the heating apparatus and the other for low-pressure steam, which is connected to the vacuum system and supplied to some tenants for drying purposes, formerly requiring live steam at pressures reaching 25 lb. The back-pressure on the engine never exceeds ½ lb. above atmosphere, and, it is stated, is frequently below atmosphere.

On investigation of shops using indirect systems, where benches were located next to outside walls, it was found that the moving air was chilled in passing by windows and traveled across the benches, creating an uncomfortable draft for the bench workers. It was decided to move the benches out about 6 in. from the wall, and to use a small amount of direct radiation to offset this effect and produce a sheet of warm air next to the windows. The result has been very satisfactory. Reducing the indirect radiation to equivalent direct, and adding the direct, the actual ratio of cubic feet of space heated to square feet of radiation is about 80 to 1.

As to the electrical equipment, a voltage of 500 was adopted, as that is the voltage of the outside public service lines, and it was desirable to have an electric connection with the Narragansett Electric Light Co., for night, Sunday and holiday use. All the motors are wound for 500 volts, and for lighting a balancer is used, consisting of two 3.5-kw. 250-volt machines connected together mechanically and mounted on one base. These machines operate in series across 500 volts, and a connection is made to the conductor that connects the two in series, giving 250 volts between the latter and each outside or main conductor. The lights are divided between the two sides, and the balancer simply provides for the excess on one side or the other.



Throughout the day all current used is taken from the generator. At 6 P. M. the switches on the switchboard are thrown over to the public-service feeders. Each tenant buys current by meter from the owners of the building, and therefore is at liberty to use as much or as little as desired, and at any time. The shop occupied by the owners of the building is well equipped with individual motors on a number of tools, while others are grouped, according to the class of work, so that the motors driving them can be shut down when work is not being done. As a result, with a total motor capacity of 41.5 h.-p., which represents the maximum load, the average horse-power during the working hours on the basis of a month's record, is 13.4. The motors are mostly supported from the timbers carrying the floor above, occupying no floor space and easily accessible by means of a short step ladder. There are two electric elevators, one freight and one passenger, built by the Rhode Island Elevator & Machine Co. The passenger elevator is equipped with electric control. There is also a Gould triplex electric pump for the water supply for manufacturing purposes, obtained from a well on the site. The pump is driven by a 1-h.-p. motor and is automatically controlled to keep a roof tank filled. One man runs the plant. All coal is weighed and the output of the generator is measured by a wattmeter on the switchboard, so that a continuous record is kept of running conditions.

In conclusion, it may be said that the engine and boiler rooms present a notably clean ap-

pearance, the walls being white above a dark-red wainscoting, and a coal car being employed to hold coal in the boiler room ready for firing. The direct radiation and piping was installed by the Merrill Co., of Boston. The wiring was done mostly by day work, while the motors were furnished by the Holtzer-Cabot Electric Co., of Brookline, Mass.

Losses in Electric Power Transmission.

Losses in electric power transmission was the subject of some unusually interesting figures in a paper presented by Mr. A. S. Richey, electrical engineer of the Indiana Union Traction Co., Anderson, Ind., before the Indiana Electric Railway Association, at Indianapolis. These prefaced in part the valuable figures, on cost of power production, noticed editorially in the issue of Jan. 28. It appears that there are 800 miles of interurban railways in Indiana, operating 100 cars regularly, and that 24 power stations furnish current to these cars, with a combined station capacity slightly over 20,000 kw., or an installed capacity in generators of about 200 kw. for each interurban car operated. The average weight of the 100 cars in regular daily operation is 25.61 tons, and their average scheduled speed is 20 miles per hour. Assuming a power consumption of 100 watt-hours per ton mile, the author calculated that the average total consumption is 5,000 kw. The average load factor of the power stations appears to be about 40 per cent. of the installed capacity, so that the average station output at the bus-bars is 8,000 kw., which indicates that the aggregate losses in overhead lines, rail return, substation apparatus, step-up transformers and the like amounts to some 3,000 kw., or an average efficiency from the station bus-bars to the car motors of 60 per cent. Only 20 per cent. of the railway power generated in the State outside of Indianapolis is the output of direct-current generators. Allowing 20 per cent. for the transmission losses from the direct-current stations, leaves an efficiency of about 55 per cent. for the remaining 75 per cent. of the generated power which is the product of alternating-current stations. This efficiency, the author stated, is probably made up about as follows: Efficiency of step-up transformers, 94 per cent.; of transmission lines, 97 per cent.; of step-down transformers, 93 per cent.; of rotary converters, 80 per cent.; of direct-current distribution, 80 per cent.; combined efficiency, 54 per cent. The figures given as the efficiencies of transformers and rotary converters will, he explained, not compare with the efficiencies guaranteed by manufacturers, as the guaranteed efficiencies are based on full load or nearly full-load conditions, while the average load on rotary converter substations in the service in question is hardly greater than 25 per cent. of their rated capacities.

A Deep Well Pump arranged to be driven from either one of a pair of 4x8-in. vertical engines was installed some time ago in a brewery in Cape Town, South Africa, by Messrs. Hayward Tyler & Co., of London. Either engine, which operates at 175 r.p.m., can be thrown into gear with the horizontal pump shaft, which is thereby driven at 25 r.p.m. This shaft carries two disks, one having the crank to which is attached the pump rod, and the other a crank from which is hung a rod to the balance weight. The pump barrel is 5½ in. in bore by 30 in. stroke and the pump rod has a 4-in. gun-metal plunger which makes the pump double-acting. The plant, as described in "Engineering," was designed to deliver 3,600 gal. of water per hour from a depth of 100 ft. below the surface to a height of 60 ft. above it.

Extent of Infiltration through Perforations in Manhole Covers.

By Alexander Potter, Assoc. M. Am. Soc. C. E.

Last June the construction of the joint outlet sewer for a number of municipalities and municipal corporations in New Jersey was completed and put into successful operation. The towns using this joint sewer include Newark, Elizabeth, Summit, South Orange, West Orange, Irvington, Millburn, Short Hills, Vailsburg and Roselle Park. According to contracts between them, each municipality has a right to a certain capacity in the main sewer and its various branches.

To ascertain the extent to which each town is using its allotted capacity, continuous records of the flow from weir measurements and automatic gauges have been kept. Fourteen measuring stations have been established, and the flow in the sewer is being accurately determined. This has given opportunity for the observation of several important facts.

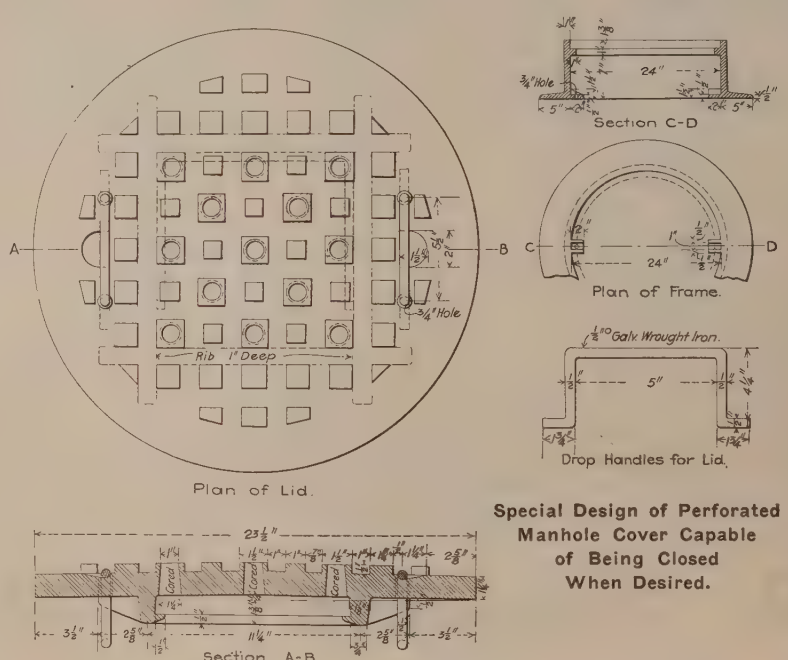
One of the most important facts so far developed is the extent to which water admitted through the perforations in the manhole covers affects the flow in the sewer. The records of the fifth, sixth and seventh of January illustrate this point very clearly.

It may be recalled by your readers in that territory that on the fifth and sixth of that month there was about 6 to 8 in. of snow covering the ground, and that on the afternoon and evening of Jan. 6 a rain, accompanied by a marked rise in temperature, caused a rapid melting of the snow. Considerable construction work was in progress at this time, from which the depth of frost in the ground was easily determined and found to be from 6 to 18 in. No catch basins are connected with the system and no roof water is admitted. Under these conditions the increased flow in the sewer must have entered through the manhole covers. There are 125 miles of sewers in the system and about 1,995 manholes, on all but thirty of which the covers are perforated for ventilation, this being a necessary adjunct when a sewer is first built and before house connections are made sufficient to secure proper ventilation of the sewer to insure its safety from the accumulation of gases. About 250 of these manholes have imperfectly fitting covers also, so that water can enter the sewer around the outer edge of the cover. These are being replaced, so that the difficulty in the future will accrue only from the perforations in the covers.

The normal flow of the sewer before the thaw of Jan. 6 was 4,800,000 gal. per day. For several hours on Jan. 7 the sewer, which has a capacity of 20,000,000 gal. per day, ran full, but in 24 hours thereafter the normal flow was nearly restored. From various recording stations throughout the system the same results were observed, with the exception that the peak was of shorter duration on the upper stretches of the sewer.

Every sewer engineer knows the difficulty of trying to plug the perforations in the manhole covers. It is only a matter of days, or weeks at most, before the filling material is forced out by the jar and impact of horses' feet and much travel. Much study has doubtless been given to this difficulty and much patience exercised in the constant refilling of the holes, or perhaps they have in many cases in time been neglected altogether, to the great detriment of the sewer in storm.

On the plan of a manhole cover sent herewith, a positive method of closing off the perforations in the covers when needed no longer is shown. A shoulder or flange is cast at the bottom of the inside of three sides of the rectangular strengthening rib, which shoulder forms a support for a plate. The perforations and the space between the under side of the cover and the plate can be filled with cement, sulphur-sand, or other filling means. In practice the plate is readily inserted, and under the most severe test the filling means will not come out.



Special Design of Perforated Manhole Cover Capable of Being Closed When Desired.

As near as could be determined, 3,000,000 gal. of water entered the sewer in 24 hours through the manhole covers, or an average of 1.1 gal. per minute per manhole. It becomes important therefore to provide means for the exclusion of this unnecessary tax upon the sewer, and the value of the above method is therefore apparent.

The Test of a Diesel Engine of 160 b.h.p., directly coupled to a 100-kw. railway generator installed in a sub-station of the Dudley & Stourbridge Tramways Co., England, to supply an outlying portion of the railway system, was reported in a paper by Mr. A. J. Lawson before the Glasgow Technical College Scientific Society. It is credited with producing power at the rate of 0.664 lb. of oil per kilowatt-hour, including 14.5 lb. per hour for friction losses, or 0.32 lb. per indicated horse-power on full load.

Construction of Foundations for the Yonkers Power House of the New York Central R. R.

The 30,000-kw. power house at Glenwood, Yonkers, for the development of electrical power for the train service south of Tarrytown to the New York terminal, covers a 265x265-ft. rectangular area in what was formerly shallow water on the east shore of the Hudson River, adjacent to the four main lines of the Hudson River Division of the Railroad. The rock bottom was overlaid by deep mud, clay and boulders in which over 5,500 bearing piles were driven about 3 ft. apart by four floating and two land machines with 4,000-lb. hammers. The pile tops were cut off by hand, sometimes as many as 500 per day, at a height of 8 ft. below mean high tide, and covered with a solid mat of reinforced and water-proofed concrete extending 1 foot below the pile tops and forming a footing on which the concrete foundations for the superstructure are built, as shown in the general plan published in The Engineering Record of Dec. 10, 1904. The condensation water tunnels, wall footings, chimney bases, column piers and engine foundations, all of concrete, are built on this footing and the space around and between them will be filled with clean sand up to mean high tide level, where it will be covered with a 6-in. concrete floor enclosed by water-proofed sidewalls carried up 1 ft. above extreme high tide. The construction of this part of the building involved important cofferdam and concreting work and special plant which are the subject of this description.

Cofferdam and Construction Plant for Yonkers Power House.

The site is surrounded on the three river sides by a sheet pile cofferdam which was commenced before the driving of the bearing piles was completed. Bearing piles for the permanent dock enclosing the site on three sides were driven and on them tracks were laid for two land pile driving machines with 2,800-lb. hammers which commenced together on the north end of the site, and moving away from each other, drove a single line of 10x10-in. piles from 20 to 40 ft. long with bevelled ends and 3x4-in. splines. They were driven between upper and lower double waling timbers bolted to guide piles about 8 ft. apart in two rows. Great care was taken to drive them plumb and in close contact and they were secured while being driven, by a clamp block dogged to the top of the last pile driven, and by a lower sliding guide block held in place by a tackle with its fall line led to the capstain head of a hoisting engine. After the piles were driven men on rafts covered the joints above low water level, with two thicknesses of cotton cloth held in place by vertical 1-in. batten pieces nailed on.

The cofferdam was so tight that it was emptied by 8, 10 and 12-inch direct connected Morris centrifugal pumps and one 6-in. Blake pump. Afterwards the water was easily kept down by a single 10-inch centrifugal pump working at about one fourth capacity. Some trouble was experienced with water rising in the bottom of the excavation and in such cases concrete was laid up around the spring, leaving a hole which was later covered with canvas and concrete filled in on top to seal it. A 10-in. vitrified pipe, not required in the contract drawings, was laid by the contractor from the shore side of the cofferdam, through the middle of the site to a sump near the river side and served to drain the excavation satisfactorily. As the water was pumped out of the cofferdam the walls of the latter were braced by inclined struts to the foundation piles which were successively removed and braced against seats on the concrete mat as the latter was completed.

All concrete forms were made with 2-in. planed boards with square edges. Those for the engine foundations were rather complicated and with the forms for the chimney bases were made with vertical and inclined timbers set in place and covered with board siding as required, the forms being stripped off and the materials used again after the concrete had set two days or more, according to the convenience of the contractor. The forms for the pyramidal piers for the columns were built with a pair of trapezoidal sides made with horizontal boards and battens on the inclined edges and across the middle, corresponding to the faces of the piers many of which were duplicates. These were placed opposite each other and connected by 7x4-ft. panels made with horizontal boards and transverse battens, and set with one long edge on the mat and the sides nailed to the inclined edges of the trapezoidal pieces beyond which the ends of the panels projected. These moulds were braced by struts from one pier to another and by other inclined struts having their lower ends engaging cleats on the surface of the mat. All moulds were braced from the outside and none had tie rods through them. Some difficulty was experienced in ramming the concrete under the battered sides of the moulds for the column piers but it was accomplished by a man working inside with a short, light rammer. Care was taken to spread a layer of mortar over the bottom of the pier and on the side faces next the mould before the concrete was placed there.

Broken stone, cement and sand were delivered by barges to the dock on the north side of the cofferdam and the cement was stored in a shed there of about 3,000 barrels capacity. Sand and stone were unloaded in clam shell and Steubner steel dumping buckets of one yard capacity and handled by a derrick with a 30-ft. boom which delivered to two side stone, and one center sand, storage bins in the top of a 30x30-ft. concrete tower about 60 ft. high, located near the middle of the south side of the site.

Each bin has a capacity of about 125 yards and its flat bottom is provided with hopper outlets controlled by horizontal steel gates operated by vertical hand levers. The center bin is provided near the bottom with two horizontal tiers of four 2-in. live steam pipes to warm the sand in cold weather. It has two rows of six gates each which deliver to steel cars on two transverse tracks on the measuring floor of the tower. The stone bins each have one row of six gates delivering to similar cars each of which has an inclined bottom with a side discharging chute controlled by a vertical sliding gate. The cars have a capacity of about 1 yard and were built by the Wonham-Magor Engineering Works, New York. They are filled up to gauge marks on the sides with sand and stone and their contents are simultaneously discharged to the two mixing hoppers set in the floor about 20 ft. apart, each one between a stone and a sand car track and directly over a concrete mixing machine in the lower story of the tower.

Cement bags are brought on hand trucks down a short incline from the store house to the foot of the concrete tower and are raised to the measuring floor in lots of six by a whip line operated by one of the capstain heads on the hoisting engine for the unloading derrick. The requisite number of bags of cement are emptied on top of the sand and stone in the mixing hopper and the aggregate is delivered to the mixing machine when the attendant below opens the bottom gate. The two cubical mixers, made by the Municipal Engineering Company, Chicago, are continuously revolved by separate independent vertical engines which drive them through sprocket chains. The mixers are mounted on rocker frames which revolve 90 degrees in a vertical plane by a rack motion operated by a clutch geared to the driving shaft. During the mixing process the axis is horizontal but it is tilted to dump the concrete through a cylindrical spout attached to the mixer in the line of the axis. The mixer is supplied through a similar spout on the opposite end which receives the materials through an inclined chute while the axis is in a horizontal position. The mixers discharge into 1-yd. steel buckets made by the G. L. Steubner Iron Works, Long Island City, and carried on small flat cars pushed by hand over service tracks of 2-ft. gauge at the level of the dock floor. By this arrangement the two mixers are entirely independent of each other and have a capacity of about 250 yd. each in 10 hours. The average output of the plant has been about 150 yards and the maximum 500 yd. in 9 hours.

Water for the concrete mixers is delivered under city pressure to a 500-gal. cylindrical tank on the top of the concrete tower and is warmed in cold weather by a live steam coil. The tank supplies a barrel at each mixer where

a variable quantity of water is measured for each batch of concrete, being proportioned according to the circumstances and the judgment of the inspector. In very cold weather 1 lb. of salt is added to each 16 gal. of water used, a quart of dry salt is thrown into the mixer with each batch and all fresh-laid concrete is immediately covered with heavy tarpaulins; precautions which have proved completely successful in preventing the concrete from freezing before it sets. All concrete is made with Atlas Portland cement, tested at the mills where it is put up in lots of 600 bags, sealed and marked with a letter for each kiln and a number for each lot. It is stored at the mills and shipped about as required, being generally unloaded directly from the barge to the concrete tower and the supply in the storage house reserved for emergencies. Occasional samples of cement are taken as the work progresses and tested as a check on the mill reports.

Two double lines of service tracks are carried across the site from south to north each about 50 ft. from the center line of the building and supported on the centers of the transverse ties of the traveler tracks of 22½ ft. gauge carried at dock level by four lines of posts provided for that purpose. Each traveler has a horizontal platform about 5 ft. clear of the track and is provided with two stiff-leg derricks with 50-ft. booms and separate hoisting engines and boilers. These booms command all the site and deposit the concrete wherever required, except when it is put in dump cars and discharged from them directly through the tracks or into chutes which distribute it over a considerable width, under and parallel to the traveler tracks.

The work was designed and is being executed under the direction of the Engineering Department of the New York Central & Hudson River Railroad Company, Mr. W. J. Wilgus, fifth vice-president, Mr. H. Fernstrom, chief engineer, Mr. Olaf Hoff, engineer of structures, and Mr. W. F. Jordan, resident engineer. Mr. Walter Butler is the contractor for the substructure, Mr. Cooley Butler in charge and Mr. E. A. Little, superintendent.

Bursting of Cast-Iron Pipe Fittings under Steam Pressure.

The bursting of cast-iron fittings when subjected to steam pressure and struck with a hammer was discussed in a recent paper read before the American Association for the Advancement of Science, by Prof. D. S. Jacobus, of Stevens Institute. In a case where a man was killed by the bursting of an elbow on a steam main near which he was working, the question arose as to the number of pieces into which such an elbow would be broken if it were struck with a hammer when under steam pressure. Tests were made on fittings of the same size and weight as the one which caused the accident and on some smaller fittings. The fitting which caused the accident was an extra heavy elbow for a 3-in. standard pipe. The smaller fittings which were tested were of 2-in. standard size and of the ordinary weight. In the tests the elbows were broken by hitting them with a hammer swung by hand when they were subjected to pressures of 80 and 100 lb. per square inch. The hammer, together with its handle, weighed 4 lb. The fittings were struck on the outside directly over each of the screw threads at points directly opposite the neck and in the plane passing through the pipe centers. The extra heavy 3-in. elbows broke in two nearly symmetrical halves, the plane of breakage being that passing through the pipe centers. The 2-in. fittings of ordinary weight broke into two to four or more irregular pieces.

Traffic Sustained by Asphalt and Granite Block Pavements on Prominent New York Streets.

By Clifford Richardson.

In a paper read by Captain (now General) Francis V. Greene before the American Society of Civil Engineers, Dec. 16, 1885, the results are given of certain observations made with the view of determining the actual and comparative traffic on the streets of certain cities, and whether the pavements on these streets properly fulfill the object for which they are designed. Since that time no further observations of a similar nature have been made in New York with the exception of a count of the number of vehicles passing per day at four points on Fifth Ave. in 1896 before that street was paved with asphalt. On this account, the Barber Asphalt Paving Co., in the months of November and December, 1904, made an accurate determination of the traffic on some of the most important streets in New York, paved with both asphalt and granite block, with two objects in view; first, to determine how much the traffic had increaesed in nineteen years, and, second, how large a tonnage an asphalt pavement such as that on Fifth Ave., which has been extremely successful, might be able to carry without disintegration. A summary of the results are presented in the following tables:

Traffic Record in New York City, N. Y.

	Tonnage, per 11 hrs.	Average tonnage per lin. ft. of width per 11 hrs.	Average tonnage per hr.	Average number of vehicles per 11 hrs.	Av'ge tonnage per vehicle.
On Streets Paved with Asphalt.					
4th St., from Wooster St. to West Broadway	9,254.22	289.18	841.35	3,394	2.73
Eighth Ave., from 35th to 36th St.	13,024.52	296.02	1,184.05	5,720	2.28
34th St., from Broadway to Seventh Ave.	2,176.60	89.22	197.86	1,072	2.03
First Ave., from 25th to 27th St.	19,253.76	435.58	1,750.34	6,034	3.18
Fifth Ave., from 33d to 34th St.	19,274.47	481.85	1,752.20	11,787	1.64
Broadway, from 18th to 19th St.	7,491.70	299.63	681.06	3,817	1.97
On Streets Paved with Granite Blocks.					
Tenth Ave., from 22d to 23d St.	7,732.78	227.45	702.98	2,873	2.69
3d St., from Mercer to Greene St.	3,933.80	140.50	357.62	1,569	2.51
Second Ave., from 34th to 35th St.	2,729.79	117.86	493.01	1,222	2.24
Broadway, from Franklin to Leonard St.	5,668.22	202.42	515.29	3,259	1.74

By reference to the tables given by Captain Greene, it appears that on thirty-six streets in ten cities the heaviest traffic was found in New York, on Broadway, near Pine, 273 tons per lineal foot of width of street, while at Fifth Ave., opposite the Worth Monument, it was only 94 tons. From the data recently collected it seems that none of the streets on which a count was made in 1904 carried a traffic less than that of Broadway in 1885, with the exception of one crosstown street. Thirty-fourth St.

The most important comparison is in regard to the tonnage per lineal foot carried by Fifth Ave. in 1885 and in 1904, after a period of nineteen years. In 1904 it was found to be 481 tons per lineal foot of width, where in 1885 it was only 94, showing that the traffic has increased fivefold in that period. The vehicles in 1885 were 5,460; in 1896, 6,300 before the street was paved with asphalt; and in 1904, 11,787. The average weight per vehicle for 1886 on Fifth Ave. was 0.68 ton, in 1904 it was 1.64 tons. On Broadway in 1886 it was 1.39 tons, and in 1904 1.97 tons. From this the conclusion is drawn that a very much larger number of heavy teams use Fifth Ave. at the present time than twenty years ago, while there has been a decided increase in the average weight of the vehicles on the other streets.

An examination of the data in regard to streets paved with granite blocks shows that these streets, either owing to the fact that they are paved with stone, and, consequently, have not a smooth surface or are not main arteries of travel, do not begin to carry the heavy traffic that the streets paved with asphalt do.

As a whole the results are very surprising as regards the increase in traffic in 20 years and as showing that an asphalt pavement, when well constructed on a concrete base, is able to carry a traffic which very nearly equals the latest data which are available as to that on heavy traffic streets in London and Paris, as shown in quotations by Captain Greene from a paper by Mr. Howarth before the Institution of Civil Engineers in 1879, from which it appears that the heaviest traffic was on Grace Church St. in London, which amounted to 422 tons per foot width for the entire 24 hours, as compared with 482 tons on Fifth Ave. during 11 hours, in the former case, 12,148 vehicles representing the traffic, and in the latter 11,787 vehicles.

The data as a whole point to the fact that a well-constructed asphalt pavement is quite suited to sustain the heaviest traffic with which we are acquainted.

Practical Work of Constructing Sidewalks.

A paper presented at the Indianapolis Cement Users' Convention by Albert T. Gridley, Aurora, Ind.

The specifications uniformly given by myself for cement sidewalk-paving are: First, excavate to a uniform depth of 11 in. below the finished grade; second, fill with stone-coal cinders (not ashes) 7 in. when well rammed to place; when the concrete is ready dampen the cinders to prevent absorption of water from the concrete; third, on the top of the rammed cinders fill 3 in. deep with cement concrete prepared as hereinafter described and thoroughly rammed to place; fourth, then finish with 1 in. of fine cement mortar as hereinafter described. The fine cement mortar is made (all parts by bulk) of one part of Portland cement to two parts of clean sharp sand, mixed dry in a water-tight box. The concrete is made of five parts of durable stone crushed to a ¾-in. mesh and thoroughly screened to one part of the fine cement mortar. In mixing the concrete first place the stone on a large water-tight platform, then wet thoroughly, then apply the fine cement mortar (dry as yet) and mix until every particle of the stone is coated with the fine cement mortar, and apply to the work at once, thoroughly ramming to place. While the concrete is being rammed to place, sufficient fine cement mortar should be wet enough to move freely under the trowel, immediately applied to the work, thoroughly troweled down against the concrete, "rodded-off" with a straight-edge held so as to compress the mortar, and rough-finished with a plasterer's trowel. The work will then be left for the finisher, who will first float the work to a uniform surface and then give it a good polish with the trowel. Gravel with no pebble larger than ¾-in. may be substituted for the crushed stone before named, and where the gravel has sufficient sand of good quality mixed with it, naturally, the concrete may be made by mixing the Portland cement, one part to eight, directly with such fine gravel, first dry and then wet only enough to pack solidly and then immediately applied to the work.

Very simple in the telling and quite true, but it doesn't necessarily secure good work, hence we need to consider some of the requisites that cannot be entered up in the written specifications. The first is a council that will stand by

the engineer in his effort to secure good work. The people pay for good work, and the council should see that they get it. The next requisite is a city engineer with a backbone, one sufficiently stiff enough to discharge an unfaithful workman "instanter," and to compel the contractor to realize the very important fact (to him) that good Portland cement work is of less monetary cost that poor work. Very few contractors are practical cement workers; are not in the business for their health but to make money; and are slow to realize that in this particular case (regardless of other cases) good work has a first cost less than poor work. We will consider some other like requisites further along.

The selection of the materials should be left entirely to the engineer. As to the Portland cement, I have found no such difference as is claimed by the various makers and by many cement users. Different brands work differently, but good results can be had from any. I have found it best to give the workmen that brand with which they best like to work. As to stone or gravel, I can say only that it must be durable. Many kinds of stone "air-slake" and dissolve out of the work. To say "clean sharp sand" is sufficient, but some may not know just what is meant by "sharp." It means a sand that shows acute angles under the microscope, and is so hard that when rubbed between the thumb and fingers none crumbles and no dust forms. It should give a good, sharp, clean ring when handled with a shovel. My test is to mix the cement and sand in such proportions as to bring out a plainly discernible "slate-green" color. If it is impracticable to develop that color, I get some sand with which it can be done. It is my opinion that more defective work is due to a poor quality of sand than to all other causes combined. Too much insistence cannot be made that all the materials must be clean. The entire virtue of cement is in its adhesiveness. If the materials are not clean the adhesion will not take place. This applies to the water as well as to the other materials.

Some critic may say that he has had good work from sand which showed considerable color on the hand and that made the water yellow when thrown into it. Quite true, and quite untrue. The result is apparently, in many instances, better work. But it is only in appearance. The clay which makes this color is not calcined, and sooner or later dissolves out of the work with corresponding loss of strength. Many years ago masons and plasterers learned that with a clean sharp sand and well burned lime as good results were not had with clean water as with water to which some yellow clay was added and well stirred in before mixing with the lime and sand. It was this very mixture which led to the discovery or invention of Portland cement. These same old-time masons knew that the clay would dissolve out of the work where the work was exposed to the rains. To obviate the difficulty they took the same old Thames mud and burned lime and mixed them, burned them again together, ground them and used them as they had the lime. The work thus produced so much resembled the natural Portland stone that this mixture was called, in turn, Portland cement. This name yet holds good, and the principle yet remains that you cannot make durable work out of unburned clay.

The substructure of the sidewalk may be of the natural surface, crushed stone, gravel or cinders. The essential point is to secure certain drainage. If that cannot be had in any other way drain tile must be used. I prefer cinders because they part with the water more readily than do other materials, and with them there is no tendency to the formation of "frost-nails," which is the prime cause of cracking of the work. Just here I want to enter a protest against the use of deep-tongued tools in finishing between the blocks. The usual specifications for dividing the work into blocks are: Divide the concrete into blocks of not more than 25 sq. ft. area with a sand joint not more than ½ in. wide. Also divide the finish coat into like blocks with the joints exactly over the sand joints in the concrete with a trowel-cut only and finish with a marking-tool having a tongue not more than ¼ in. deep nor more than 1/16 in. thick and joined to the plate with a radius of not more than ⅛ in. Yet I frequently find men using a marker having a tongue 1 in. deep and ¼ in. thick. The theory for this is that the deep cutting prevents cracking beyond the cut. It doesn't; hence the theory is incorrect. The trowel-cut makes a permanent division in the top coat. The shallow marker presses the edges close together, but they do not unite, and so prevents the entrance of water into the joint; hence there is no expansion to push the blocks apart. Great care should be had that none of the dry sand used in making the "sand-joint" in the concrete is permitted to fall upon the top of the concrete. If it does it will prevent the cap, or fine cement mortar, from uniting with the concrete, and the cap will be loose and liable to crack off to that extent.

Among the workmen are some requisites that cannot be written in the specifications. Oftener than otherwise among the common laborers will be found a better stripper than among expert carpenters. It is just a knack in setting the side-rails for pavements and backs, fronts and divisions for curbs and gutters, that some men have and others do not. Again every mason and plasterer knows that there is much in the tempering of the mortar, and a good mason or plasterer demands the services of someone whom he considers to be an expert at that work. It is all in the "look" and the "feel," and some men have the knack for it and others do not. Usually it is best to employ an expert finisher, but, often, among the day laborers will be found a man who will readily get the knack of knowing just when to apply the float and just how to apply the trowel to get a fine finish upon the work. Here is where the city engineer gets in his fine work. It is in being able, not to do the work himself, but to select readily the men who will do the work. Men do best that which they like best. The engineer should be able to detect that in a man which he likes best and so can do best, and thus make his own work easy and sure.

To councilmen I would say, cut out your superintendents. Usually political favorites, rarely with any practical knowledge, and wholly without any legal power, they are more a hindrance than a benefit to the work. Make your engineer responsible for good work. If he needs supervision assistants, let him select them and make him responsible for their acts.

Last, but not least, I want to say something about the tamping and ramming. Both the tensile and the compression strength of the work are largely dependent upon this one thing and everybody cannot do it. The rammer is usually an iron plate with an upright handle. If this falls but a very little diagonally it stirs up the work instead of compacting it. Among any ten common laborers will be found at least one who will be found to have a knack at dropping the rammer square upon the work. He who can do this will have no jar from the handle to his arms, and the dread of the tool which most laborers have will entirely disappear. Such a man will do twice the work of others and do it well where the others do it ill, and do it satisfactorily to himself.

As for repairs, where Portland cement work is broken, remove the broken part and cut away to a clean surface. Then dampen this clean surface and cover very lightly with dry cement and immediately apply the new material which is to take the place of the part removed, and finish as at first. If a part of the work becomes worn and presents a coarse, rough surface, it is because the finish coat was not properly tempered in the making of the work. The best remedy is to take equal parts of unslaked lime and Portland cement, and, within a spell of fine weather, sprinkle lightly all over the worn places, and leave it to be kicked about by the feet of passersby until after a rain. Much surer effects will be attained by making several applications than by applying all at once.

A Study for a Central Power and Heating Plant at Washington.

Last spring Congress directed the Superintendent of the Library Building and Grounds, Mr. Bernard R. Green, M. Am. Soc. C. E., to make an investigation of the cost and design of a central station for power and heating service for the thirteen existing and projected government buildings on the Mall and in the vicinity of the White House. In carrying out these studies, Mr. Green was assisted by Prof. S. Homer Woodbridge, whose detailed report on the project has just been printed in connection with that of Mr. Green, the two forming a valuable and interesting discussion of an important problem.

There will be fifteen distinct advantages and economies which will follow the construction of a central station, according to Mr. Green, who lists them as follows:

(1) By combining the buildings of the Executive group in one system of heating, power, and lighting service, more than seventy boilers, now operated at twenty-six different points, would be reduced to ten boilers located in one room. Instead of being various in form, power and efficiency, these would be uniform in type and size, and of high efficiency.

(2) The coal burned would be low priced and of high thermal value and without the waste or nuisance of smoke, and materially less in quantity than the high-priced anthracite of lower calorific power, now burned chiefly to avoid the inevitable dirt and smoke attending the combustion of soft coal under the present conditions.

(3) The use of economizers and superheaters, more applicable to large and steady running plants than to small and unevenly running plants, would add to the economy of operation.

(4) The use of all exhaust steam, for nearly two-thirds of the year, for heating purposes, would remove the principal cost of the production of power during the heating period, and render the surplus of steam used for power in one building available for heating another.

(5) The use of condensing engines of high grade and economy would produce energy for power and lighting at reduced cost in the warmer months.

(6) The storage battery would serve to even the work of the boilers and engines, to remove the chief occasion for smoke, and to reduce the night work of the plant and therefore the night force of the men.

(7) The electric service of power and light now purchased would be done away with for the Treasury, Winder, Court of Claims, Agricultural, Smithsonian group, Army Medical Museum, and other minor buildings, through its cheaper production at the central station.

(8) The compacting of the isolated plants and the use of modern labor-saving devices, more economically applicable to large boiler and engine installations, would reduce the necessary number and cost of personal attendants.

to less than half that required by the buildings separately manned.

(9) The space vacated in buildings by the present boilers, generating engines and accessories, coal bunkers, etc., and made useful for storage and other purposes, would aggregate 600,000 cu. ft., or a space equivalent to 170 ft. square by 20 ft. high. Such an amount of space costs, in usual Government building construction, more than $100,000.

(10) All heat, dust, noise, gases, smoke nuisance, and such danger as attends high-pressure steam production in the buildings, would be avoided.

(11) By proper construction and operation of such a plant the economy of the use of soft coal could be depended upon with practical freedom from smoke at all times.

(12) Hot-water circulation direct from the power house proves to be not only better adapted to most of the heating apparatus of existing buildings, but far more economical and practical for transmission to them from the central station. The one or two buildings now fitted for steam instead of hot-water heating, being fortunately near to the proposed central station, can be furnished with steam. It would, however, be better in every way if they contained hot-water fixtures.

(13) A direct, instead of an alternating, electric current for lighting and power proves the more economical and conforms to the current for which the several buildings are already wired and equipped.

(14) The annual profits accruing from such a centralized plant and service are estimated at about 11.5 per cent. on the investment. In other words, the plant may be expected to repay its first cost within ten years after it is put into operation. Including the probable cost of the ground, the profits would repay the first cost in thirteen years.

(15) In round numbers, the gross cost of the central station and plant, exclusive of the land, would be $1,400,000. Deducting from this the value of the extra size of the power house, at least $150,000, and the saving of steam and generating plants in the three buildings now going up, namely, the Agricultural, Municipal, and the National Museum buildings, say, $182,000, gives the net cost of the proposed central plant for immediate needs as $1,068,000.

An examination of the several items of unavoidable costs, as also those of possible profit, in the erection and operation of a central plant, led Professor Woodbridge to decide that, in order to secure the largest profit, the station should furnish the largest service. In general the profit incident to the service of a central plant varies inversely as the distance between the station and the points served, and directly, though not proportional, as to the duty or amount of service performed by the plant.

The economies possible under any scheme for installing and operating either, and only, a power or a heating central station plant, and the retention of the other in the buildings, would be so seriously narrowed as to make the grounds for advocating such a plant far less tenable than are those found to exist in support of a central plant which shall unite the two divisions of the work. Any such partial treatment of the problem would result, in Professor Woodbridge's opinion, in a costly increase of steam-generating plants, including emergency reserves, however the division might be made; in a large increased cost in generators and other equipment, if these are segregated; and in an unreduced pay roll under any divided arrangement. The losses which necessarily would be entailed are those due to failure to secure from one division of the service the economic advantages it would contribute to the other, and also those due to the absence of the effective organization and vigilant surveillance which are far more easily obtainable in an aggregated than in a segregated plant. Little, if any, usable space would be gained within buildings; the nuisance of dirt and smoke and heat would be but little abated; and the high cost of smokeless coal would make against economy, whatever the division, and the waste attending low efficiency in engine work would be continued and increased by an extension of the system, and the heat of engine-exhaust steam would be but partially utilized, or wholly lost, if the segregation were on the side of power.

The matter of first importance in the selection of a site for the proposed central station is that the location shall be most favorable to economy in matters of installation and especially of operation, or, in other words, which shall make the station central and reduce distances of service to a minimum. The records of coal consumption for heating, ventilating, power and lighting in the buildings, and of the purchased electrical service furnished to some of them, have supplied the data necessary to determine the centers of balance for both thermal and electrical consumption. These two points being determined, the most economic locations for heat and electricity generation for distribution are approximately indicated.

The location selected is bounded by B, C, 14th and 15th Sts. N. W. It is easily accessible by electric tramway, by which the power station may be connected direct with the steam railway and from which the steam railway coal cars may be drawn, preferably at night when passenger traffic is suspended. The tide water may be brought to the site by piping carried through a large and vacated sewer in the close vicinity, and waste water may be disposed of through the same sewer way.

The site from which thermal and electrical distribution to present and projected buildings would be in nearest balance having been found, the study of costs involved in changing the several segregated plants to an aggregated plant was taken up.

The required maximum power and heating capacities of a central station were computed from data furnished from records and logs obtained from the superintendents, custodians, or engineers of those buildings. By means of those, season aggregates and the daily average, and also the daily and hourly maximums, have been obtainable in relation to coal consumption and to electrical quantities used.

The power of the proposed combined plant for the above group of buildings is made less than that of the total equipment for segregated plants in the same buildings; first, because of the higher steaming efficiency practically obtainable in the boilers of a highly organized and skilfully operated power plant; and, second, for the reason that the isolated plants must each be given a generous factor of safety for performing occasional exceptionally heavy duty, as well as providing against breakdown and other emergencies. The serving of the Executive group of buildings from one common plant would remove the necessity of furnishing a surplus of power and equipment equal to performing such duties or to meeting such emergencies in all of the buildings at one and the same time. Because of that fact, a substantial reduction in the steam-generating plant of a central station may be safely made, Professor Woodbridge states. In place of the present 73 boilers in 20 or more isolated stations, aggregating some 4,500 h.-p., a central station equipment, which shall include boilers for the three additional and large buildings, may not contain more than ten boilers of 400 h.-p. each, all in one boiler room. On an emergency, high-efficiency boilers having a nominal capacity of 4,000 h.-p. could be easily forced to a 6,000 h.-p. steam output.

Objection to the selected location would be reasonable on the ground of smoke nuisance if a smokeless operation of the plant were not assured, for wherever the plant may be located, the prevailing winds of winter and summer will carry the chimney products eastward, with a trend to north in summer and to south in winter. The low cost of bituminous coal and the high thermal value which it possesses justify both the initial expense of providing proper furnaces and appliances, and also the continuous but remunerative expenses of intelligence, faithfulness, and skill on the part of attendants in charge of the firing, and the further cost of a storage battery for meeting emergencies and easing fires. Smoke should not be allowed and may be almost wholly excluded from chimney discharges. With suitable boilers and furnaces and draft, and by easy and regular rather than by forced and unequal firing, smoke may be so eliminated as to become negligible.

The total capacity of the electric generating part of the required equipment is much less in the aggregated than in the corresponding segregated plant adapted to the same service, but divided into twelve installations at as many stations. The equipment of each isolated station necessarily includes emergency engines, generators, and accessories to an extent which in a corresponding aggregated plant would be out of all useful proportion.

The usual and required emergency equipment for the aggregated plant should have reference to excessive loads of short duration, or to temporary disablement of apparatus which may be quickly restored to service. These occasions must be provided for by reserve or emergency equipment, if the performance of the plant is to satisfy a reasonable demand. In the matter of light and power, that equipment may be either in boilers, engines, and generators, to create and furnish emergency power on demand, or else, with a more equal work of boilers and engines, in the storing of electrical energy unused during the long periods of light load, and made available for use in the shorter "peak" periods of high loads or at times of accident or other emergency. The cost of emergency or accident equipment by the reservoir method is approximately the same as that for the generating method of equal capacity, and the cost of maintenance is somewhat greater in the former than in the latter. The economic gain in operating costs by storage methods is chiefly on the side of reduced fuel consumption. Roughly, the capacity of a plant for generating emergency or "peak" power on demand must, in this instance, be approximately 40 per cent. in excess of that of a plant capable of the same work by a stored electrical supply. The usual practice of continuously maintaining full steam pressure in all power boilers, even in summer time, in order to be prepared for a suddenly darkened sky or other emergency, is so productive of fuel waste and of service expense as to warrant the installation and use of a storage plant which shall reduce by 40 per cent. the capacity of the generating equipment, lessen the summer coal consumption, and curtail the expenses of labor service by making night attendants for boilers and engines unnecessary during the summer months. To the advantages named must be added the further important function of the storage battery already noticed, viz.: that of evening the work of boilers and of fires and of reducing and removing the causes which tend to produce smoke.

The hourly maximum heat required for

warming and ventilating the Executive group of buildings during the periods of extreme weather is considerably reduced, Professor Woodbridge points out, by the massiveness and the high specific heat of the material of which the buildings are constructed. Such material in such mass in itself stores large heat quantities, which it partially yields to contained air whenever the temperature of that air falls even a little below the temperature of the material. Such storing and yielding of heat in buildings of monumental character make unnecessary that provision in the power of the heating system which is requisite in lightly constructed buildings for maintaining an even internal temperature during short and sharp depressions of weather temperature.

The peak heat requirement of the buildings which a central plant would immediately serve is approximately 2,650,000 thermal units per minute, if the amount of ventilation furnished in zero weather is liberal. The water capacity of a hot-water system adapted to that work for the Executive group, and including underground and building piping, radiators, tanks, etc., would approximate 160,000 gal. The entire quantity of water would, therefore, be rotated once each fifteen minutes. Therefore, large as the system storage quantity would be, its function as a heat-storage reservoir would be small in relation to the several consecutive hours, and even days, of high heat demand. To reach proportions of any considerable practical value, a reservoir having the capacity of many hundred thousand cubic feet would be necessary. It would seem advisable, therefore, that reliance for an adequate performance of extreme duty be placed primarily on the boiler power provided; and, secondly, on the conserving action of the buildings themselves; and, finally, on a reasonable restriction of ventilation during the sharper cold, when the necessity for free ventilation is less urgent than in warmer weather.

Weather temperature changes take place with such relatively gradual movement and with such premonitory warnings, that fires can easily be built, forced, banked, or drawn to meet requirements, as cannot be done on either the electric side, in lighting, to meet the quick darkening of the sky or winter daily calls, morning and afternoon, for light; or in office fan work, with the dying out of summer breezes, of the quick rise of oppressive humidity or the shifting of heating sunshine from one already heated side of buildings to heat the other; or on the power side to meet the peak elevator work, as four times a day thousands crowd the elevator service.

Heat may be conveyed from a central station to the buildings of the executive group either by steam or by water. If by steam at low pressure, the conveying pipes must be given suitable sizes to carry the needed heat at the low-heat quantity possessed by each cubic foot of steam when moved under the small pressure differences then available between the feed and the delivery ends of such pipes. If prohibitively high back pressure on engines is to be avoided, the pressure used for distributing steam must then be made correspondingly low and pipes proportionately large. The maintenance of any degree of vacuum at the engines by a reduction of steam pressure below atmospheric within the distributing pipes and the radiator systems would be impracticable, because of the greater vacuum which would be made necessary at the buildings in order to produce a vacuum result at the engines.

The difficulty, if not the impossibility, of maintaining such partial vacuum throughout the entire system would be serious, if not practically insurmountable, on account of the multiplicity of possible and probable leakages at fittings, valve and fixture joints, valve stems, and also through a considerable aggregate of "pin," "sand," and like holes in the 500,000 sq. ft. of metal surface involved. Furthermore, the large surface of low-pressure distributing pipes required would result in a corresponding leakage and loss of heat from the pipe lines.

Low-pressure live steam for heat transmission is economically disadvantageous on account of the larger cost of piping material, of trenches, and of insulation, and because of the large loss of heat in exhaust steam which, under such conditions, would probably be thrown to waste. High-pressure steam service is superior to low only on the score of lower first cost of pipe installation and a somewhat lower rate of heat loss, the small pipe surface more than offsetting its greater per-unit-of-surface rate of heat loss.

The heat quantities lost by steam piping when properly protected from ground and atmospheric moisture, and when thoroughly insulated with the best non-conducting material, is shown in the table for pipes of equal length and for the various sizes indicated, and when supplied with steam at the initial pressure given, the steam dropping to atmospheric pressure at the delivery ends. The heat losses are expressed in thermal units per hour, and are probably the lowest economically obtainable by the best practicable protection and insulation, as hereinafter described. The length of pipes is one-fourth mile; the steam quantity passing into pipes for transmission is 150 lb. per minute, the pressure dropping from the initial given to atmospheric at the delivery ends.

Heat Losses in One-Fourth Mile of Protected Steam Pipe.

Size.	Initial pressure. lbs. to sq. in.	Heat losses per hr. B.t.u.
4-in. pipe	45.00	81,600
5-in. "	25.00	94,200
6-in. "	10.80	101,900
7-in. "	6.00	113,300
8-in. "	3.70	126,000
9-in. "	1.50	138,100
10-in. "	1.00	152,500

The table makes evident the economic advantage of high pressure over low in the single matter of the relative heat wastes from small and large pipes, and is in itself an argument against the use of low steam pressures in large distributing pipes.

The cost of maintenance of high-pressure pipe lines would, however, prove larger than that for low-pressure pipes, because of expansion strains, and also on account of the higher temperatures and humidities of trench spaces, which would tend to a deleterious condensation of moisture on and to a rusting of the cooler return piping, both of which processes would be more active than if pressures and temperatures were low.

However carried, steam used as a heat conveyor cannot utilize the exhaust from engines in a distributing system having the large proportions and distances of that under discussion. That exhaust represents a total thermal quantity for the heating season equivalent to approximately 2,500 tons of coal, or between $7,000 and $9,000, according to the cost of coal used.

Water may be driven through pipes at any advantageous speed by centrifugal pumps and at a negligible cost, since all the heat of the steam used in driving of pumps to impel water motion may be given to the water moved, and the energy of water motion itself is finally transformed into heat within the water. Furthermore, the heat yielded or conveyed by a cubic foot of water when its temperature is dropped through 30° Fahr. is largely in excess of that yielded or conveyed by a cubic foot of steam, even at very high pressure.

Water pipes have one distinctive and important advantage over steam pipes, since the pressures to which the water pipes are subjected are nearly constant, and for the larger pipes those pressures are relatively low. Strains are therefore light and but slightly variable.

In the matter of durability, under favorable conditions, water piping may outlast steam piping. If the system is reasonably tight, and the same body of water is continuously used, the free oxygen in the water supply having been once expelled or exhausted, internal corrosion is arrested, and the piping will then last indefinitely. The temperatures of supply and return mains are so nearly the same that condensation on the external surface of the cooler pipe is retarded, if not prevented, and external corrosion due to that cause is correspondingly prevented, and a long life of the piping is equally insured. Furthermore, the temperature of the pipe line is low, and the heat loss is proportionately reduced. The necessity of doubling the pipe surface, by running both supply and return pipes of the same size, brings up the total loss for the same heat transmission to nearly that of high-pressure steam piping and of its condensation return piping.

The accompanying table gives the heat losses in thermal units per hour from single water pipes of the sizes given, one-fourth mile long, and containing water at a temperature of 150°, and when the pipes are in parallel, and insulated, and protected against moisture in the very best manner practicable, the mean temperature of earth about the trench being 50° Fahr.

Heat Losses in One-Fourth Mile of Hot-Water Pipe.

Pipe sizes.	Water temperature.	Heat losses B.t.u. per hr.	Pipe sizes.	Water temperature.	Heat losses, B.t.u. per hr.
4-in.	150°	48,100	8-in.	150°	74,400
5-in.	150°	57,200	9-in.	150°	83,300
7-in.	150°	65,800	10-in.	150°	93,000

The use of water makes continuity in gradient lines unnecessary, avoids the use of trench traps, and reduces the number of expansion joints required, so favoring minimum costs in construction, in waste, and in maintenance. Furthermore, some of the largest buildings are at present equipped with hot-water heating systems, making the cost of change to adapt them to a central plant relatively small. For these reasons of major and minor economies the preference is therefore given to water as the most appropriate vehicle for heat conveyance.

The pressures required to distribute water through a pipe system one-fourth mile in length, and in sufficient quantity when cooled 30°, to convey per minute the heat equivalent to 150 lb. of steam at atmospheric pressure and condensed at 212°, are shown in the following table:

Pipe sizes.	Steam.*	Water Volume, gal.	Water Pressure column, ft.	Water Pressure Lbs., per sq. in.
4-in.	45.0	606	361.0	157.00
5-in.	25.0	606	112.0	47.00
6-in.	10.8	606	44.7	18.70
7-in.	6.0	606	25.0	10.50
8-in.	3.7	606	10.1	4.20
9-in.	1.5	606	5.95	2.50
10-in.	1.0	606	3.30	1.38

*Initial pressure per square inch.

The two essentials to an economical transmission of heat through long pipe-line distances are: First, such rapidity of travel of the thermal vehicle through the channels that time for leakage of heat from each unit of volume or of weight of that vehicle shall be short; second, such insulation of the pipe surfaces that the rate of heat leakage from each unit of pipe surface shall be small. Swift flow and small leakage are both favored by a use of the smallest pipes practicable. Such pipes have already been noted as possessing other economic advantages.

Defectiveness of insulating material and in methods of its application are responsible for the excessive losses which attend much of present heat distribution from central stations. In scores of cases on record the mean of such loss reaches from 15 per cent. at the lowest to 33 per cent. at the highest of the total heat passed into interred-pipe systems. These high losses are partly due, however, to the large number of branch connections made with buildings along the entire length of pipe lines, and also to a probable inferior manner of insulating and protecting such branches against heat loss.

For the purpose of reducing the first cost of installation and also the after cost of heat loss from pipes, the pipe plan is proportioned for a working-pressure difference between the feed and discharge sides of the centrifugal pump of 200 ft. hydraulic head, or 100 ft. propulsion and 100 ft. suction. Such a drop of pressure on the suction side of the pump is made practicable because of the hydrostatic head of 122 ft. to which the circulating system would be subjected, due to the height of the fourth floor of the State, War and Navy building. Such static pressure would neutralize the suction effect of the pump, and, with the pump working on the cooler side of the heater, would prevent any liability of a vapor break in the water.

It is further advised that the water be circulated in such manner that in the coldest weather it shall lose not more than 30° in temperatures in complete circuit, and that the ratio of the length of time the water may be retained in the buildings to that it shall be in traversing the pipes shall be made as large as practicable.

The maximum quantity of water proposed for the system for the Executive group is 11,500 gal. per minute, or roughly, 88,000 lb. The maximum drop in temperature proposed for severe weather is 30°, making the corresponding heat quantity approximately 2,640,000 units per minute. It is computed that the average heat quantity passed into the pipes will be 50 per cent. of the above named, or 1,320,000 thermal units per minute, or very nearly 79,200,000 thermal units per hour. With good firing, such steam heat should be produced by the burning of 4 tons of coal; or 80 tons for the average, and 160 tons for the extreme day of twenty firing hours; a probable total of some 16,000 tons for the heating season.

The estimated heat loss from transmission pipes is 0.25 thermal unit an hour per square foot of pipe surface and for one degre of temperature difference between the pipe surface and the earth temperature outside the walls of the trench, the pipes being embedded in granulated cork. The average water temperature is estimated at 150°, and that of the earth at 45° Fahr. The average loss per square foot of pipe surface would then become 26½ thermal units per hour. That loss per square foot multiplied by the total area of the pipe surface, namely, 64,000 sq. ft., gives 1,696,000 thermal units per hour as the average loss. This quantity is 2.14 per cent. of the heat supplied to the pipe system, and is equivalent to 0.0848 ton of coal per hour, or 2.04 tons per day of the heating season of 200 days, making a yearly total of 408 tons.

The piping for heat distribution would aggregate 2½ miles of double run. All pipes should be covered either in trenches or in tunnels. Of the two forms of channel, the tunnel and the trench, the former is to be preferred for accessibility to pipes, and also for the accommodation of and accessibility to electric cables. The trench, while rendering pipes inaccessible, presents the important advantage of cheapness, and makes possible a superior insulation for the pipes by a complete filling of the trench about the pipes with the best, and at the same time the cheapest, of insulating material. The material best adapted to that purpose, provided the pipe temperature is not high, is granulated cork.

Like the methods discussed in connection with heat transmission, the two methods for the transmission of electrical energy from the central station to the buildings are those of high pressure and small cables, or of low pressure and large cables. Both are possible and feasible. The investigation relating to this matter was begun with the expectation that ascertained facts, when fully obtained and carefully weighed, would lead to a conclusion clearly in favor of a use of the high-potential and alternating system. The investigation made has been painstaking and exhaustive, Professor Woodbridge says, the entire subject having been considered with reference to cost of installation, operation, and maintenance; of changes required in the present equipment of buildings; of transmission and conversion losses; of adaptation to the several kinds of service to be rendered; of attendance, and also with reference to adaptability, reliability, and simplicity of equipment and of current application. The investigation detailed in that paper has rendered it evident that for the average transmission distance and for the average transmission load, and for the nature of the work peculiar to this case, the low-potential direct current is preferable to the high-potential alternating current for power and light distribution from the central station.

Fire Tests of Automatic Sprinklers.

Tests with automatic sprinklers were conducted at Newark, on Dec. 2, in the Belleville Ave. car house of the Public Service Corporation of New Jersey, by the Underwriters' Electrical Bureau of New York. The sprinkler equipment was divided into two systems. The ceiling of the ridge form of roof was equipped with sprinklers, the highest line being 32 ft. above ground, and the four aisles between cars were protected with double low-lines bringing the heads about even with the tops of the car windows on both sides. The ceiling sprinklers were spaced about 8x8 ft. apart and the low-line sprinklers about 5 ft. apart. Part were made by the General Fire Extinguisher Co., of Providence, and part by the Manufacturers' Automatic Sprinkler Co., of New York.

In the first test, a car in the center row in the front of the car house was fired, with all windows closed, doors open and just enough paper under the seats to start the car blazing. The fire gained considerable headway before the glass in the windows broke and before the sprinklers could be operated on by the heat. The car was set on fire at both ends, and the first sprinkler, which was one on the low-line opposite the windows, opened 4 min. after the fire was started. Altogether during the test, ten sprinklers opened and the fire was extinguished in 18 min. after the opening of the first sprinkler. Throughout the test the fire was confined to the car in which it originated. In this test the city water pressure, which was from 32 lb. to 34 lb., was used.

In the second test the car was set on fire, with the windows and doors open, and with just enough paper and excelsior to start the car blazing. In this test a Worthington centrifugal pump was used, in which the water pressure was raised to 75 lb. to 80 lb. The first sprinkler, which was one on the low-line, opened 1½ min. after the fire was started, and the fire was practically extinguished in 2½ min. after the first sprinkler opened, or in 4 min. after the fire was started. Eleven sprinklers opened.

In the third test the entire interior of the car was saturated with kerosene oil. In addition, the windows were closed, while the doors were kept open. The automatic pump was connected to the water system as in the second test. In this case the first sprinkler opened in 45 sec. after the fire was started, and the fire was practically out in 4¼ min. after the fire was started, ten sprinklers having opened. It appeared that the hottest fire proved to be the easiest to extinguish.

Tests of Reinforced Concrete Beams.

Tests of reinforced concrete beams in the Kensington Ave. paint shop of the Philadelphia Rapid Transit Co., which were designed and built by the Reinforced Cement Construction Co. under the direction of the Philadelphia office of the latter company, were made on Dec. 8. From a report of the tests submitted by Mr. R. C. Heath, assistant engineer, to Mr. W. S. Twining, chief engineer of the railway company, the conditions of the tests and the deflections observed were obtained. A sprinkler car weighing, empty, 20,000 lb., and filled with water until the total weight was 40,000 lb., was located in the second story of the building on rails carried by beams having 21 ft. span center to center of the supporting columns. The car was carried by a four-wheel truck having a 7-ft. wheel base, and it was placed in a central point with respect to the two beams, transmitting to the beams four cencentrated loads of 10,000 lb. each at points 7 ft. from the ends of the beams. The deflection at the center measured from below was 1/16 in. These beams, of the span stated, are 6 in. wide and 14 in. deep, and the main reinforcing members are four 1-in. rods. There is also a transfer table in the second story; this is run on four lines of rails, at distances of 7 ft., 7 ft. 3½ in., and 7 ft. on centers, carried by 18x18-in. beams, which are 17 ft. 1 in. in length of span, and in turn carried by girders of 48 ft. span, 18 in. thick and 39½ in. high. The car was run upon the transfer table and a loading of 12,000 lb. at four concentrated points arranged for; a deflection of 3/64 in. was observed. It was stated that with the transfer car in motion the deflections were slightly greater than shown for the stationary load, and that slight deflections were shown also in the next span, indicating that the load, although apparently concentrated on one section of the floor, was distributed through the floor to the next line of beams. The main reinforcement of the 48-ft. span beams includes 18 rods of 1½ in. diameter, of which six lie along the top; the rail supporting beams for the transfer table have six 1-in. rods and two ¾-in. rods as the main reinforcement. the latter in the top. The loading in practice, as called for in the specifications, is 24,000 lb. concentrated at four points, so that the test load was 66 per cent. in excess of the requirements.

A Cushion Floor for Bridges was described by Mr. E. K. Morse at a recent meeting of the Engineers' Society of Western Pennsylvania. In the bridges where it has been tried, the floor was covered with ⅜-in. plates on which 12 in. of granulated cinder from blast furnaces was placed. The track was laid on this cinder in the usual manner. The result is a very smooth-riding track easily kept in repair and of material help in preventing damage in case of wrecks and derailments, which have occurred several times. The cinders weigh about 15 lb. per cubic foot when first laid, but pack to about 35 lb. This floor, Mr. Morse states, would be particularly useful where it is desirable to deaden the sound of trains passing over bridges in cities.

Letters to the Editor.

A REGULATING VALVE FOR DOUBLE RESERVOIR SERVICE.

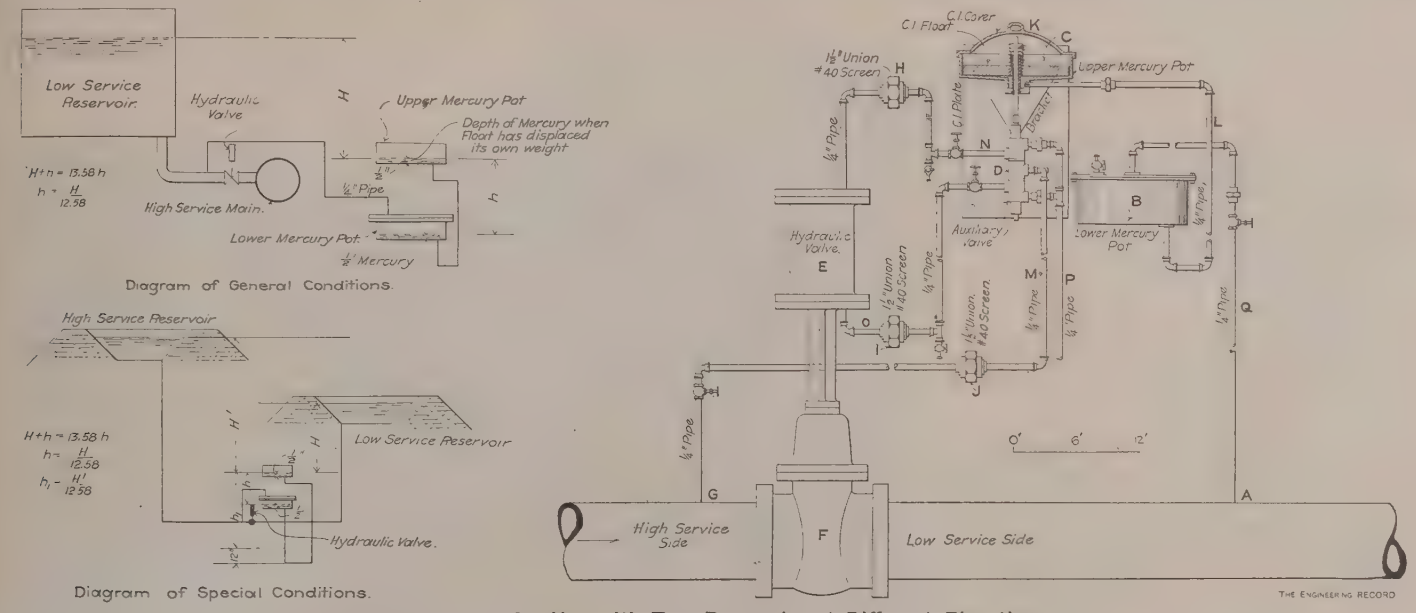
Sir:—Please find enclosed a blue-print showing a device that the American Pipe Manufacturing Co. has had in operation for several years. I would be pleased to have you publish a description of this, as I believe it would be of interest to a great many of your readers. The purpose of this device [patented by Mr. Ledoux.—Ed.] is to regulate automatically the height of water in a distributing reservoir or standpipe, when the water is flowing from another reservoir intake at a higher elevation.

B is a closed cylindrical mercury reservoir, and C an open cylindrical mercury float reservoir with a loose removable cover, K. F is a hydraulic valve operated by hydraulic cylinder E. Water flows in the direction of the arrow into a reservoir or standpipe until it is full, or the elevation of water in it is at the desired height. The pressure due to this height acts on the mercury reservoir B through the pipe Q, the mercury passes up through the pipe L into the float chamber C, raising the float and operating the auxiliary five-way valve D, so as to permit water to pass through the pipes M and N into the upper portion of the hydraulic cylinder E; and at the same time the bottom of the hydraulic cylinder drains through the pipe Q back through the auxiliary valve D, and out of the waste pipe P, which in many cases may be connected with the low-service side of the valve F. This operation closes valve F. When the reservoir lowers a few inches the float in chamber C will fall and the auxiliary valve D will operate so as to permit water to pass through the pipe M and through the auxiliary valve and through the pipe O to the bottom of the hydraulic cylinder E, and at the same time drain the top of the cylinder through the pipe N through the auxiliary valve and through the waste pipe P, thus opening valve F. At points H, I and J are placed couplings containing metal screens which prevent dirt from getting into the auxiliary valve.

In some cases this apparatus is operated by having the pipe Q connected on the opposite side of the hydraulic valve F. In this manner water will flow into the reservoir or standpipe until it is full, when the valve F will close as before. It will open just as soon as the pressure on the high-service side falls to a point equal to what it would be if the valve F were open, and the reservoir were drawn down a few inches. This is frequently the case and is particularly useful where there is a large consumption on the high-service side of the hydraulic valve. Theoretically, it would be desirable to have the hydraulic valve of the balanced type, in which case the hydraulic cylinder E could be very much smaller. For ordinary cases we usually specify the hydraulic cylinder 2 in. larger in diameter than that of the valve.

It is evident that the hydraulic valve F need not be the full size of the main, in fact, it is an advantage to have it smaller. It could be as small as one-third the diameter, and connected to the main pipe with reducers or otherwise. By means of the diagrams the apparatus can be located to suit the conditions and elevations existing in any particular case. It will be seen that the auxiliary apparatus is mounted on a plate, and the mercury vessel B can rest on a suitable support fixed at the required height.

If the main is very long, say ten miles or more, the question of water hammer would have to be considered when regulating the speed at which the hydraulic valve closes. Rather than throttle too much the small pipe



Special Valve for Use with Two Reservoirs at Different Elevations.

This conclusion may be correct in so far as it relates to bridges like the Brooklyn bridge, designed to carry very heavy loads, as six or eight railway tracks and roads for wagons, pedestrians or bicycles. But the same conclusions are not correct if we consider bridges designed to carry lighter loads, as is often the case. The author of the said article is not explicit on this point. Nevertheless, it is a most important one.

In general, whenever in the construction of metal bridges other than suspension bridges, either by reason of the length of the span or the lightness of the excess loads, the latter become practically of little importance in comparison with the dead weight of the bridge; that is to say, whenever in the calculation of the strength of the members the principal and determining condition is that the bridge shall support itself then in such a case one can say a priori that the suspension bridge is very economical.

If the material of the suspension bridge is relatively more expensive, this disadvantage is balanced by the fact that for equal weights it has much higher strength than the material of other bridges. The material of the suspension

operation on many of our plants, and it operates with absolute certainty. By its use the level of water in the reservoir can be controlled to within from 1 to 3 in. from the mean level. In one case that we have watched closely the valve continued to act for two years without a single failure. Not knowing definitely of the others, we assume that they are acting in the same satisfactory manner.

Yours truly, J. W. LEDOUX.

Philadelphia, Jan. 30.

STIFFENED SUSPENSION BRIDGES.

Sir:—In The Engineering Record for Nov. 5, 1904, under the title of "Improved Types of Stiffened Suspension Bridges," there was published an interesting editorial article relating to the most recent improvements in this class of bridges. The author of the article, after having shown the progress accomplished in the last 60 or 70 years in the construction of metallic bridges in general, arrives at a conclusion which seems, as far as suspension bridges are concerned, to be rather unfavorable, that is, that these bridges are not really economical as compared with other systems, except for the greatest spans, the lower limit of such spans being placed at about 2,000 ft.

bridge has furthermore the advantage of acting always in tension. We may have recourse to the familiar but particularly striking demonstration of an equilibrist walking upon a steel thread of 20 to 25 ft. in length which is so fine as to be almost invisible. We may then ask what would be the weight of a metal beam of the same span resting freely on its two points of support in order to bear the same load. These considerations will make it clear why in France and in England it has often been found advantageous to recur to the employment of suspension bridges even for short spans, when the live loads were comparatively unimportant.

As an example of the economy which may be realized in such a case, we may cite the bridges built by the Société du Haut-Ogooué in the French Congo, bridges of very inconsiderable span, in some cases as little as 24 m. The photograph herewith shows one of these bridges with a span of 28 m. A number of these bridges were built varying from 42 to 24 m. in span and about 2½ m. width in the clear. The trusses are composed entirely of steel cables.

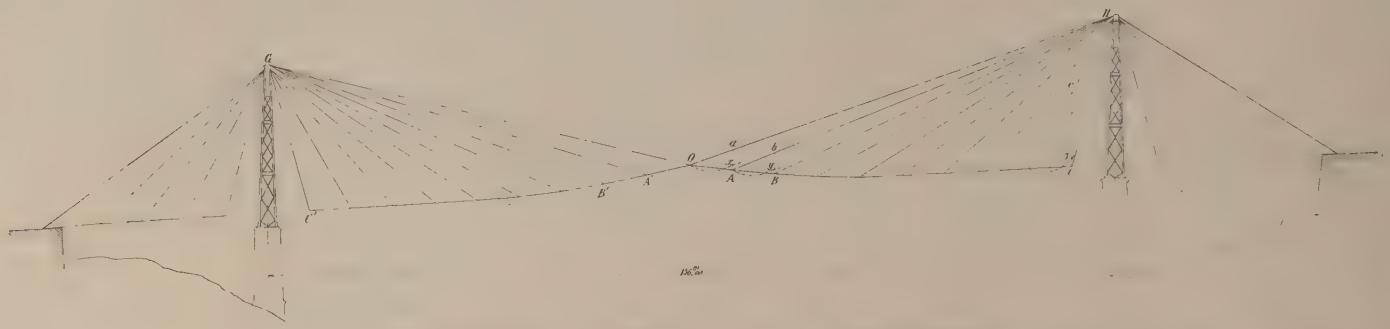
These bridges were so successful that a longer bridge on the same plan is now in course of construction in France on the railway line from Villefranche de Conflent to Bourg-Madame. This bridge has a central span of 156 m. and two end spans of 39 m. each. It carries a single track for an electric railway, and is designed to support a live load consisting of an indefinite series of heavy typical electric cars of 10.80 m. length weighing each 32,000 kg., which corresponds to a mean excess load of 2,963 kg. per running meter (nearly 2,000 lb. per linear foot). The floor is of steel, 6 m. wide. The maximum deformation calculated at the middle of the bridge under the standard load is 1/1,000 of the span, or a deflection of 0.156 m.

The total weight of metal entering into the construction of the bridge is 696,000 kg. distributed as follows: Steel cables, 109,350 kg.; suspension rods, attachments, joint members and expansion chairs, 77,200 kg.; anchorages in the abutments, 16,900 kg.; towers, 107,300 kg.; floor and hand rails and braces, 385,250 kg. These weights are practically greater than necessary, but were required by the Consul General of Bridges and Roads, who deemed it pertinent to have an excess of strength in all parts of the bridge for the first trial on a large scale.

The cost of the metal parts is about 380,000 francs ($76,000).

The principle of these bridges is in general identical with that of the Gisclard type previously referred to. For example, we will consider the diagram herewith, showing one of the suspension trusses. This truss has always the form of an inverted arch with three hinges G, O and H, each of the half trusses being composed essentially of a lower chord O, A, B, C (or O, A′, B′, C′), and of a series of ties radiating from one of the points of suspension H or G.

The points O, A, B, C being the joints to which are attached the rods supporting the floor of the bridge, it will be easily seen that whatever be the distribution of the loads on the floor, the lower chords O, A, B, C . . . O, A′, B′, C′, as well as the extreme ties C, H and C′, G, are always in tension, but it cannot be conceded *a priori* that the other ties are necessarily in tension. These elements in fact would not remain continually in tension unless the direction of the lower chord shall satisfy certain simple conditions. For this we may recur to the fundamental theory on which the Gisclard system previously referred to rests. We see then, as far as the tie O H is concerned, that in order to have this always in tension, it is necessary, and it is sufficient that the lower envelope of all the polygons of force passing through the points G, O and H under



Railway Bridge between Villefranche de Conflent and Bourg-Madame, France.

Gisclard Type of Bridge in the French Congo.

different positions of the assumed loads shall cut the imaginary ordinate A a at a point within the truss, that is to say, a point between A and a. Taking the middle hinge O as the point of departure for our line O, A, the above principle permits us to determine the point A, placing it as nearly as we please to its upper limit x.

The point A being thus determined, we can consider the remainder of the half truss a complete truss suspended at the two fixed points O and H with an intermediate hinge at A.

In the same way we may say that in order that A H shall always be in tension, it is necessary that the lower envelope of the polygons of force corresponding to this part of the construction, and passing through the three points O, A and H shall cut the ordinate B b at a point between B and b as v. This condition determines the position of the point B exactly as the position of the point A has been determined. Then from B we can determine in the same way the position of the following joint, and so on to the last joint of the lower chord of the truss, which may then be connected to the point of suspension H to obtain the last of the radiating ties.

The general principle is therefore the same as that of the Gisclard type previously referred to. It follows that the new variation, although of different form, has the essential characteristic of the former type. That is to say, whatever the distribution of the loads on the floor of the bridge, the stresses never change in direction in any of the elements of the suspension truss.

This specific example seems to demonstrate that where moderate live loads are in question the suspension truss may yet rival the non-suspension types in practical economy as well as in theoretical attractiveness. It is not likely that the actual use of the bridge will develop any defects which could not have been foreseen by the highly skilled bridge engineers of the present day. The mere fact of its being built, seems conclusive of its adaptability to the conditions required.

Yours truly, D. A. Usina.

New York, Jan. 27.

A Public Dry Dock in Boston has been investigated by the Massachusetts Harbor and Land Commission and declared inadvisable on account of its cost.

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ELECTRICAL GROWTH IN 1904.

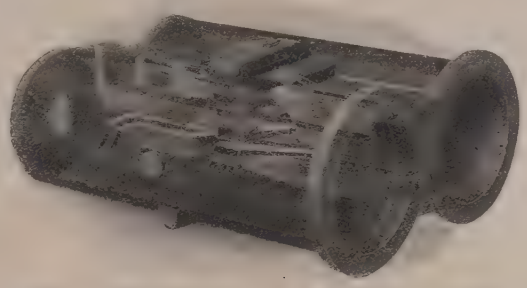
Pursuant to its usual plan, the "Electrical World and Engineer" printed in its issue of Jan. 7 an estimate of the value of the electrical apparatus produced in the United States during 1904. The total amount is given as $175,500,000, which, as compared with the estimated total for 1903 of $158,650,000, shows a gain of $16,850,000, or something better than 10 per cent. In discussing the subject, it says: "We have some doubts as to whether, on the whole, this rate of increase has secured. In good years, and over a long period, the annual rate has been not far short of 20 per cent. gain, but 1904 was confessedly a bad year during its first half, and it is open to question whether the second half could have made such strides as to wipe out deficits and pile up a 10 per cent. gain for the whole twelve months. Still, it is possible, especially as some of the departments of the industry, such as telephony, kept up a smart advance all the time."

The detailed estimate for each division of the electrical industry was shown, and it is as follows, the figures given here being millions of dollars, first for 1903, and second for 1904: Dynamos, 17 and 18.5; transformers, 4.5 and 5; switchboards for lighting and power, 2.75 and 3; motors for all purposes, including traction, 30 and 35; storage batteries, 4.5 and 5; primary batteries, 1.25 and 1.25; carbons, 2 and 2.25; arc lamps, 2.25 and 2.5; incandescent lamps, 5.5 and 6; lighting fixtures, 3.75 and 3.75; telephonic apparatus, 25 and 30; telegraphic apparatus, 2 and 2.5; insulated wires and cables, submarine cables, 0.25 and 35; conduits, interior and underground, 1.75 and 2; rheostats, heating and cooking apparatus, 2.5 and 3; annunciators, 0.25 and 0.25; electric clocks, 0.15 and 0.15; lightning arresters, fuses, etc., 0.75 and 1; measuring instruments, 3 and 3.35; miscellaneous apparatus, 19 and 20.

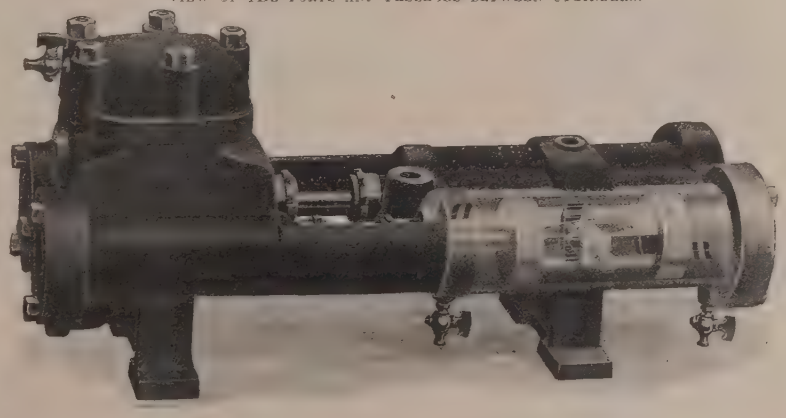
"It may be noted, in addition," it is added, "that the work done by public service corporations for the community now runs into large figures. At a moderate rate of increase over previous years, the telegraph companies in 1904 earned about $40,000,000; the telephone companies, $110,000,000; the electric light companies, $125,000,000, and the street railway companies between $275,000,000 and $300,000,000, say $290,000,000. Here we have a gigantic total of $565,000,000 earned by the four great branches of electrical industries, to which, added the $175,000,000 from electrical manufacturing, would roughly make the electrical bill of the American public in 1904 not less than $740,000,000. It was, however, more than that amount."

A NEW DUPLEX STEAM PUMP.

A new form of duplex pump, new in respect to the design of its steam end, has been brought out by The Snider-Hughes Co., of Cleveland, O. As indicated in the illustrations, it is of simple design and radically different from the construction of the ordinary duplex steam pump, although in principle of operation it presents no departure from the older form. The United States patent was allowed Sept. 16, 1904. The larger engraving shows a pump such as is suitable for boiler feeding, with one of the steam cylinders shown in phantom; the other is to serve to indicate the arrangement of the steam ports. The pump is known as the Monitor duplex steam pump.



VIEW OF THE PORTS AND PASSAGES BETWEEN CYLINDERS.



VIEW OF THIS PUMP WITH ONE CYLINDER IN PHANTOM.

The steam end consists of two steam cylinders placed side by side, each containing a steam piston, a steam valve and a piston guide. Each cylinder has a steam and an exhaust port at each end. These ports, as shown in the phantom view of the steam passages, communicate with ports situated at the center of the cylinder, with the latter port openings horizontal or longitudinal with the cylinder barrel. The ports at one end of one cylinder communicate with central ports in the adjacent wall of the other cylinder and this arrangement applies for both ends of both cylinders. In this way it is provided that the flow of steam to and from one cylinder is controlled in its mate.

The steam pistons are double, with two heads connected by a hollow cylindrical body. The pistons are so located that the two heads lie on opposite sides of the central ports at all times. The spaces between the two heads serve as a steam chest. Steam enters these spaces through a steam pipe cast across the top of the two cylinders. The piston is prevented from rolling in the cylinder by a guide which works in the straight horizontal slot in the body connecting the piston heads. This slot is shown in the view of the phantom cylinder and also the guide, which is bolted to the outside wall of the cylinder, the bolt for securing the guide to the cylinder barrel being likewise shown.

The steam valve is held in the inner end of the guide, and the latter is forked to receive the valve stem. The valve itself is of the form of a segment of a circle. The ends of the segment form the steam laps, covering and uncovering the live-steam ports, while an opening in the center of the valve surface provides for placing the exhaust ports in communication with the exhaust passage. It will be noted that a diagonal or more correctly, spiral slot is formed in the inner side of the body connecting the two piston heads, the spiral slots in the two pistons being placed face to face next to the adjacent cylinder walls and over the central ports. The steam-valve face in each case is turned to fit the cylinder wall over the central ports, as explained; and the valve stem works in the spiral slot, while its position in the forked end of the guide prevents movement of the valve endways.

The operation of the valve gear may be described by reference to the view of the assembled pump. For convenience the cylinder drawn in phantom may be called A and the other cylinder B. Imagine the steam piston in cylinder A to be moving to the right; then as the piston cannot roll and the steam valve cannot move endways, the valve will be rolled downward by the spiral slot. In this way the upper steam port will be uncovered and steam will be admitted to the right-hand end of cylinder B. At the same time the lower exhaust port will be uncovered, making connection, through the D of the steam valve, from the left-hand end of cylinder B to the main exhaust. The piston in cylinder B will therefore stroke to the left. On the reverse stroke in cylinder A the valve will be rolled upward, thereby admitting steam to the left hand end and opening the exhaust to the right-hand end of cylinder B, and the piston in cylinder B will stroke to the right. The piston and valve in cylinder B will control the steam supply to cylinder A in the same manner.

The steam valves are thus operated directly by the steam pistons and the entire mechanism consists of six parts. By removing the cylinder heads, water piston nuts and guide bolts, the entire mechanism can apparently be removed. It also appears that when the guide bolts are in place, the steam valves are properly set and no adjustments are necessary. It is stated that the removal and replacement of the parts can be done in 15 to 30 min., according to the size of the pump. It is also held that the design adds to the durability of the pump, as there are no outside working parts and the working parts have large bearings. It is stated, also, that the steam pistons are allowed to come to rest gradually at the end of each stroke, thereby giving the water valves time to close without shock, prolonging the life of the water valves and insuring smooth working at relatively high speeds.

AN INDICATING METER FOR SMALL ELECTRIC INSTALLATIONS.

Voltmeters and ammeters for switchboard work in connection with small installations and in competitive work have been brought out by the Westinghouse Electric & Manufacturing Co. The instruments are known as the type K, for use upon either direct or alternating currents. This type is a development of one of the Lord Kelvin patents controlled by the Westinghouse Co.

In shape, size, finish and general appearance, the type K instruments harmonize with the other round Westinghouse pattern switchboard types. The face has a matted surface with raised letters and an ornamental design in low relief, the entire case being finished in black enamel. The mechanism consists of a stationary coil, through which the measured current flows, the voltmeter measuring the current which flows through a high resistance. This coil acts on a movable core or plunger, which is connected with a steel beam mounted upon knife bearings and carrying the indicating pointer. There are no springs, the action being controlled by gravity.

The core is saturated with a very small amount of magnetic energy, so that for any load the attraction upon the plunger is directly proportional to the current, and the error due to residual magnetism is considered commercially negligible and the scale almost uniform, commencing with zero. On alternating currents its action is said not to be appreciably affected by changes in frequency. External fields do not influence the performance, and temperature errors are negligible.

The instruments are dead beat in their indications, the steadying effects of a dash pot being obtained by inserting the lower end of the plunger in a glass tube filled with oil. The opening in the solenoid is made small, and the plunger is a piece of fine iron wire, flexibly connected to the movement by means of a strong silk cord. Ammeters are regularly made of capacities to and including 1,000 amperes, and voltmeters to 750 volts for use without transformers. For larger capacities, transformers are supplied.

TWO TYPES OF HYDRAULIC GOVERNORS FOR WATER TURBINES.

In the illustrations on the following page are shown the operating principles of two forms of hydraulic governor suitable for the regulation of water turbines. One of these was described by Mr. L. Ribourt in a paper on regulators for hydraulic turbines, in the "Memoires" of the Society of Civil Engineers of France, while the other was illustrated in a recent issue of "Le Genie Civil." In connection with a description of a hydro-electric plant near Saint-Marcellin, France, on the Bourne River, where there are three 1,250-h.-p. units operating under about 335 ft. head. In both regulators the turbine gates are actuated by pistons which are moved under hydraulic pressure and counterbalanced by compression springs, the latter allowing the pistons to take a position corresponding to the amount of the hydraulic pressure. In both cases the hydraulic pressure is maintained by a positive rotary pump in order that the value

of the pressure might be a function of the pump speed which in turn might likewise be in some constant ratio with the generating-unit speed. The essential feature of the Ribourt regulator, however, is an obturator or stopper, as will be explained, which is made to take the place of a centrifugal governor and, in that way, overcome tendencies for hunting, while in the case of the second governor, which, together with the hydraulic apparatus in the station named, was furnished by Messrs. A. & H. Bouvier, of Grenoble, France, the interesting point lies in the fact that there is a central regulator, which governs simultaneously the gates of all three turbines. Here the apparatus is commanded by a synchronous motor, and therefore subject to the variations in speed suffered by the alternators to which it is connected.

The obturator or stopper in the Ribourt regulator occupies part of the space in the fitting G within which it is suspended. The stopper is fastened by a rod to a piston which receives above it the pressure of a coil spring, the compressibility of the latter being proportional to the pressure to which it is subjected. If water or oil is allowed to flow downward through the fitting, the movable system described is placed under the action of a differential pressure which tends to lift it, owing to the difference between the piston above and the stopper below; however, this tendency is counteracted by the spring which yields, as stated, according to the magnitude of the pressure. The fitting is, moreover, cut with divergent grooves, the free or open sections of which tend to increase as the stopper descends. For each condition of the discharge of liquid through the fitting a position of the stopper is established depending on the following different elements: Tension of the spring, the cross-section of the fitting and the pressure of the liquid. The pump delivery is passed through the fitting, and for each speed of the pump there is a corresponding pressure and a corresponding position of equilibrium for the train of apparatus connected to the stopper.

This volumetric pump is marked z in the diagram; it draws from the reservoir R and delivers into A, the circulation being made continuous through the fitting. In A is a metallic float B, serving as a piston, which can then be employed through such auxiliary hydraulic apparatus as may be necessary, to move the turbine gates, and the system included with it is completed by a small slide valve. This is connected both to the piston float and to the relay piston p by means of the racks C and J and the pinion I. In the paper in question a sectional elevation is given of the design of the governor suitable for maneuvering the distributing apparatus in the low-head turbines of the so-called American type, this regulator having a long stroke and a heavy mass to move. The plunger in the oil circuit of the regulator actuates the slide valve commanding the relay piston, which, in turn, is supplied with oil at high pressure from a small pump mounted on the same shaft with the rotary pump. It appears that considerable power can be brought to bear on the slide valve, for, the author states, with the ordinary pressure at 5.275 lb. per square inch, a slight increase in speed will raise it to twice this amount. The rest of the details can probably be inferred from the illustration.

In the second regulator, the pump delivers into a chamber, escape from which is had through an orifice, of which the section can be varied by the movement of the valve S. The position of the latter is controlled by the centrifugal governor shown. For each position of this valve there is a pressure H in the pump discharge which is obtained from the equation $Q = kS\sqrt{2gH}$, in which Q is the pump discharge; k, the coefficient of contraction; S is the cross-section of the orifice at the instant considered. When the speed is increased, the valve is lowered and the section of the orifice is progressively diminished and the pressure is increased, the discharge of the pump being, as stated, practically constant. When the speed stops increasing, the pressure maintained corresponds to the position of the valve. The pressure in the pump discharge is allowed to reach the pistons R, which are fitted with springs, as indicated, to hold each piston in a position depending on the value of the hydraulic pressure. For each position of the centrifugal governor there is a corresponding pressure of the liquid and a position of the pistons, and if the last are connected by T and V in a rigid manner to the regulating apparatus of the turbine, there will be for a given position of the governor a single possible position for the turbine gates.

It is held that the action upon the turbine gates ceases at the precise instant that the working torque of the prime mover is equal to the resisting couple; in other words, that at this moment, the pressure ceasing to rise, and the springs to compress, the whole system is in equilibrium at a new angular speed a little higher than that first considered. With an increase of load a reversal of movements, of course, occurs. It is stated that by giving the various parts of the regulator the proper proportions rapid manipulation of the turbine gates can be obtained, and the variation of speed for a change in the load

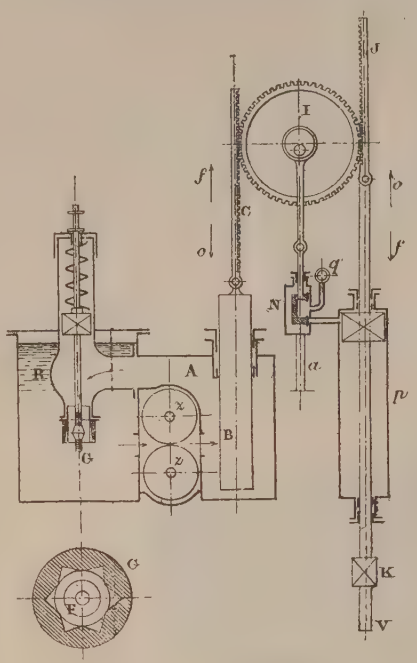


DIAGRAM OF RIBOURT GOVERNOR.

can be made as small as desired, but the chief advantage claimed is the absence of the so-called hunting action, the system being such that when the load changes, a single movement of the gate suffices, without the latter passing the position of equilibrium for the new load. This is largely accomplished, it is emphasized, by the positive pressure, depending on the speed, on one side of the pistons, and by the springs which, on the other side, allow the pistons to take a position also dependent on the liquid pressure and consequently on the speed. Like the regulator first described, this also can be arranged, when the turbine-gate apparatus is heavy, to actuate the latter through auxiliary hydraulic appliances.

The Allis-Chalmers Co., Milwaukee, Wis., has become sole licensee in North America for the manufacture and sale of the hydraulic turbines, governors and other hydraulic machinery of Escher, Wyss & Co., Zurich, Switzerland. The history of the advances made by the Swiss company in the 66 years it has been engaged in the design and manufacture of this class of machinery is given in publication No. 112 issued by the Allis-Chalmers Co. Several cuts of the larger units that have been installed in America and in Europe are shown. The largest units built are the 10,250-h.p. turbines of the Canadian Niagara Power Co., Niagara Falls, Ont. The 60,500 h.p., in 5,500-h.p. units, of the Niagara Falls Power Co., Niagara Falls, N. Y., were also designed by them. The publication contains, in addition, descriptions of the Francis type of hydraulic turbines, the high pressure impulse turbines, and the different types of hydraulic governors made by the Allis-Chalmers Co.

BUSINESS NOTES.

The Elkhorn & Ohio River Construction Co., Jersey City, N. J., has been incorporated, with a capital of $100,000, to construct and equip railways, wharves, piers, etc. The incorporators are Louis B. Dailey, H. O. Coughlan and Jos. M. Mitchell, Jersey City.

The Lafayette, Ind., Gravel & Concrete Co. has been incorporated, with a capital of $50,000, to manufacture roadway and bridge material, paving stones, railroad ties, building blocks, fences, fence posts and other cement products. The incorporators are Chas. F. Hunt, Wm. Robertson and C. R. Flinn.

The Lucius Engineering & Contracting Co., Camden, N. J., has been incorporated, with a capital of $50,000, for designing, engineering, contracting, etc. The incorporators are F. J. and E. C. Lucius and E. W. Arthur.

The Frank C. McLain Co., New York City, has been incorporated, with a capital of $300,000, to manufacture machines and engines. The directors are Frank C. McLain, J. K. Peacock and C. E. Mead.

The King Construction Co., Camden, N. J., has been incorporated, with a capital of $100,000, to do a general contracting business. The incorporators are Arthur C. and Chas. S. King and Chas. F. Woodhull.

The Vacuum Cleaner Co., North Plainfield, N. J., has been incorporated, with a capital of $1,600,000, to manufacture and deal in vacuum and other cleaning apparatus. The incorporators are David T. Kenny and Wm. G. Besler, Plainfield; Harry B. Hollins, Robt. W. DeForest, Thos. Ewing, Jr., and Wm. K. Vanderbilt, Jr., all of New York City.

The Bessemer Foundry & Machine Co., Pittsburg, Pa., has been incorporated, with a capital of $500,000, to manufacture and deal in machinery, and to do a general foundry business. The incorporators are Jas. K. and D. B. Neagley and L. B. McKean, all of Pittsburg.

R. Waddington & Sons, Hoboken, N. J., have incorporated, with a capital of $25,000, to do a general construction business. The incorporators are Robt., Joseph and Henry Waddington, Jr., of Hoboken.

The new plant at Ithaca of the Morse Chain Co., Trumansburg, N. Y., mentioned in The Engineering Record of Jan. 21, will consist of machine shop, forge shop, hardening and tempering shop, wood shop, pattern storage, foundry and offices. The power plant will consist of Westinghouse single-acting compound engines direct-connected to 80-kw. 125-volt direct-current generators from the World's Fair at St. Louis, supplied by Babcock & Wilcox boilers at 130-lb. pressure. The machine shop will be equipped with individual and group drives from 110-volt motors. Work of completing the details is now progressing rapidly, preparatory to commencing work of erection in the spring.

A new type of magnet for handling pig iron, small billets, scrap iron or steel, small steel or iron castings, bolts, rivets, etc., in bulk, has recently been put on the market by The Electric Controller & Supply Co., of Cleveland, Ohio. It is the result of long experimenting to get the most efficient design. It is adapted to be carried on the hook of a crane and controlled by the crane man, who can thus perform the entire operation of loading or unloading a car or loading melting stock into charging boxes with no ground men or helpers. The design of this magnet is radically new and is covered by letters patent.

TRADE PUBLICATIONS.

The lubricating graphite and grease m... factured by the Joseph Dixon Crucible ... Jersey City, N. J., specially for automo... and motor boats, and the most practi... methods of applying them to the various ... of these machines, are quite fully brought ... in a pamphlet recently issued by that ... pany.

Bulletin No. 1,059, of the Fort Wayne ... tric Works, Fort Wayne, Ind., describes ... shaft, the pedestal and the yoke types of ... rator commutator truing devices which ... manufactured in these works.

The American Asphaltum & Rubber ... 721-3 Woman's Temple, Chicago, Ill., ha... sued a pamphlet concerning the Par... ready-roofing, which is one of the many ... ing and construction materials produce... this company.

The Durable Steam Trap Co., Youngst... Ohio, has issued a booklet, giving several ... and diagramatic cross-sections of the ... made by this company, and a descriptio... its construction and operation.

The new catalogue of the New York C... nental Jewell Filtration Co., New York, ... the description of the various types of ... sure and gravity filters and views of the ... recent installations that have been m... among which are the plants filtering mu... pal water supplies at Oregon City, ... Moline, Ill., and the enlarged plant at ... kosh, Wis.

Flyer No. 253, issued by the Croc... Wheeler Co., deals with a new line of vari... speed motors now being built at the compa... works at Ampere, N. J. These motors ... adapted to small shops, isolated tools, ... industrial plants in which variable speed ...

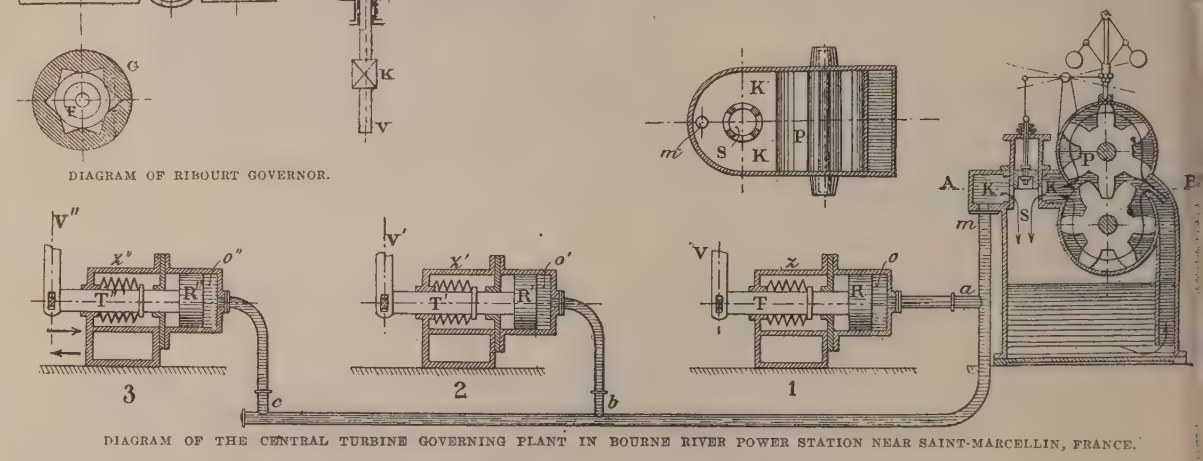


DIAGRAM OF THE CENTRAL TURBINE GOVERNING PLANT IN BOURNE RIVER POWER STATION NEAR SAINT-MARCELLIN, FRANCE.

quirements are too limited to require the ... stallation of a complete variable speed ... tem.

The Detroit Graphite Mfg. Co., Detr... Mich., has issued a folder explaining the ... of Superior graphite paint for structural s... of bridges and buildings.

A series of bulletins issued by Tinius O... & Co., 500 N. Twelfth St., Philadelphia, ... describe new types of testing machines ... duced by this firm. Among them is the th... screw testing machine, with a dial ver... beam, for which the firm received a g... medal at the Louisiana Purchase Exposit...

The American Monorail Co., Fidelity Bl... Baltimore, Md., has issued a pamp... describing the single rail track and the o... head trolley system for train operation, ... trolled by it.

PERSONAL NOTES.

Mr. George A. Carpenter has been re... pointed city engineer of Pawtucket, R. I.

Mr. Luther B. Martin has been appoin... superintendent of the East Orange, N. ... water works.

Mr. Casimir Constable, M. Am. Soc. C. ... died Feb. 6 at the home of his brother-in-... in New York City.

Mr. C. H. Cory has been appointed supe... tendent of motive power of the Cincinn... Hamilton & Dayton Ry.

Col. David P. Heap, Corps of Engine... U. S. A., has been nominated by the Pr... dent to be a brigadier-general on the reti... list.

Mr. H. M. Cryder, assistant engineer of ... Wabash Ry., has been made principal assist...

ng er in charge of construction on that

George E. Woodward, an engineer en- ng in the original construction of the Chi- ng Milwaukee & St. Paul Ry., died last ec at his home in New York City.

John R. Lotz, assistant engineer of the el are, Lackawanna & Western R. R., has ee ransferred from the Buffalo office to the ri department in the general offices of the an ny at Hoboken, N. J.

E. L. Byron has been appointed gen- ra nanager of the Vulcan Iron Works Co., which he has been connected for 20 Mr. Alexander Backus will not retire, vill be relieved by Mr. Byron of a con- able portion of his duties.

. R. B. McConney has succeeded Mr. R. ry as manager of the Denver office of the ll Chalmers Co. Mr. McConney was con- d with the Davis Iron Works of Denver bout three years, and for five years with Mine & Smelter Supply Co.

. George C. Diehl, engineer of Erie nty, N. Y., was elected president of the tly formed New York Association of nty Engineers and Road Superintendents. James A. Fowler, engineer of Orange nty, N. Y., was elected secretary.

arl Piefke, the leading German contribu- to the literature of water filtration, died month in Berlin. For many years he the engineer in charge of the Stralauer ks in that city, and when these were aban- ed in 1894 he was appointed municipal ysiologist.

lessrs. James Walker and M. M. Green e formed a partnership under the firm e of Walker & Green, consulting engi- rs, 509 Union Trust Bldg., Detroit, Mich. ey will make a specialty of investigations public corporations and industrial organiza- ns for financial interests.

dr. C. A. Colburn, a civil engineer of the iladelphia & Reading Ry., was recently iously injured by falling from the new shaminy Falls bridge on that road. He s directing the erection from the top of bridge when he slipped and fell to the cks below and was struck by a construc- n engine.

Mr. J. M. Diven has severed his connection ith the Elmira Water, Light & R. R. Co., of ich he has been secretary and treasurer ce its organization, to take charge of the ter works at Charleston, S. C. This change address is particularly called to the atten- on of members of the American Water orks Association, of which Mr. Diven is cretary and treasurer.

Prof. L. Von Tetmajer, president of the ternational Association for Testing Ma- rials, died recently in Vienna, Austria. He came secretary of the association when it as founded and was chosen president about ght years ago, which position he held until is death. Prof. Von Tetmajer was engaged mountain railroad work in Austria and witzerland for several years after finishing is technical education in Vienna. He was ter made professor at the Polytechnikum in ürich, and remained there until he was ap- ointed head of the mechanical laboratory f the Vienna Technical College.

Maj. Dan. C. Kingman, Corps of Engineers. . S. A., has been promoted to the rank of olonel. Major Kingman has had charge of he harbor improvements at Cleveland, Con- eaut, Fairport, Toledo and other points along he lower shore of Lake Erie for the past five ears. Prior to that time he was in charge f the fourth district of the Mississippi River or special improvement and the construction nd repair of levees on that stream and the ivers tributary to it. He was at one time ssistant professor of engineering in the Mili- ary Academy at West Point. Later he was ngineer of the Platte, and for five years was n charge of the improvement of the Yellow- tone National Park.

On March 31, Chevalier Luis Luiggi will nish his connection with the harbor works ear Bahia Blanca, Argentine Republic. This reat undertaking was planned by him and as been executed under his personal super- ision. The port was rendered necessary by he growth of the Argentine navy, and serves s a base of naval operations at the mouth f the River Platte. The works were begun n 1896, and have transformed a sandy desert nto a thriving town, and furnished the gov- rnment with a military port generally con- eded to be unexcelled in South America. The resident of the republic has recently pub- licly thanked Don Luis for the manner in which his duties have been discharged, and there is a movement on foot to name the port after him.

Mr. James C. Spencer, formerly consulting engineer of the Pittsburg, Ft. Wayne & Chicago Ry., died recently in Miami, Fla. His first railroad work was on the construction of the Erie R. R. in 1848. He was afterward engaged on the construction of the Hudson River Ry., and from 1852 to 1861 was constructing engineer on the Chicago & Alton Ry. and other Western railroads. At the end of that time he was appointed general manager of the Prairie du Chien Ry., now a division of the Chicago, Milwaukee & St. Paul Ry. In 1875 he was made consulting engineer of the Pittsburg, Ft. Wayne & Chicago Ry., and became receiver of the Milwaukee & Northern Ry. in 1879. Since his connection with that company Mr. Spencer was vice-president of the Northwestern Iron Co.

The following candidates for admission to the American Society of Civil Engineers were elected Feb. 1: As Members—William Brohm, Chf. Engr., Grainger & Co., Louisville, Ky.; William Crozier, Chief of Ordnance, U. S. A., Washington, D. C.; Charles C. Davis, Chf. Engr., The Massillon Bridge Co., Toledo, O.; Tokichi Endo, Chf. Engr., Nankai Ry. Co., Osaka, Japan; Louis P. Gaston, Richards & Gaston, Engrs. and Contrs., Somerville, N. J.; Luis A. Huergo, Buenos Aires, Argentine Republic; Charles Humphreys, Engr., U. S. Engr. Dept., Wheeling, W. Va.; Curtis E. Knickerbocker, Engr. M.-of-W., New York, Ontario & Western Ry. Co., Middletown, N. Y.; Arthur J. Rockwood, Div. Engr., Western Div., Dept. State Engr and Surv., Rochester, N. Y.; Raphael Smead, U. S. Asst. Engr., Washington, D. C.; Frank McC. Sylvester, Engr. in charge of construction, Dry Dock No. 3, Navy Yard, Norfolk, Va.; Edward E. Wall, Prin. Asst. Engr., Water-Works Extension, St. Louis, Mo. As Associate Members—William Babcock, Archt., New York, New Haven & Hartford R. R., New Haven, Conn.; Francis W. Belknap, Asst. Engr., Dept. of Docks and Ferries, New York City; Rodman M. Brown, with John S. Metcalf Co., Chicago, Ill.; Russell Chase, Chf. Engr., Fresno Traction Co., address North Fork, Cal.; Louis G. Fenton, with H. de B. Parsons, Cons. Engr., New York City; Herluf T. Forchhammer, Asst. Engr., Bridge Dept., Central R. R. of New Jersey, Newark, N. J.; Hermann Fougner, Head Engr., Johannesburg Branch, Milliken Bros., Johannesburg, South Africa; Albert H. Greenwood, Constr. Engr. for Berlin Constr. Co., of Berlin, Conn., address, Elizabeth, N. J.; Frank D. Holbrook, Res. Engr., Lock No. 11, Ohio River, Wellsburg, W. Va.; Alex. R. Holliday, Engr. M.-of-W., Indianapolis & Vincennes Div., Pennsylvania Co., Indianapolis, Ind.; Harry A. Lane, Asst. Engr., Baltimore & Ohio R. R., Cumberland, Md.; Louis R. Lavalle, South African representative and Contr. Agt. in coal and ore mining and handling machinery for Jeffrey Mfg. Co., Columbus, O., address Johannesburg, South Africa; Ora M. Leland, Instructor in Civil Engineering, Cornell University, Ithaca, N. Y.; William J. Lightfoot, Engr., U. S. Geological Survey, Montrose, Colo.; Henry B. Machen, Asst. Engr., Rapid Transit R. R. Comrs., New York City; Walter W. McLaughlin, Irrigation Engr., Utah Experiment Station, and Asst. Irrigation and Drainage Investigations, U. S. Dept. of Agriculture, Logan, Utah; Chauncy R. Perry, Asst. Engr., Boston Bridge Works, Boston, Mass.; Nathan H. Sanderson, Asst. Engr., Boston Bridge Works, Boston, Mass.; Ulrich Taubenheim, Mgr. of Water-Works, Archangel, Russia; Noble E. Whitford, Asst. Engr.-in-Charge, State Engr.'s Dept., Albany, N. Y. The following were transferred by the Board of Direction Jan. 31st, 1905, from the grade of Associate Member to Member—Edwin G. Adams, Jr., Tientsin, China; Samuel J. Chapleau, Ottawa, Ont., Canada; Geo. L. Christy, New York City; Hermann M. Knapp, Cincinnati, O.; Geo. W. Lilly, Columbus, O.; Gerard H. Matthes, Lawton, Okla.; Chas. S. Millard, Indianapolis, Ind.; Jos. B. Wright, New York City. The following were transferred from the grade of Associate to Member—Wolfgang G. Triest, New York City. From Associate to Associate Member—Fred. L. Stearns, New York City. The following candidates were elected Juniors: Elmer E. Barnard, Lynchburg, Va.; Robt. E. Barrett, Framingham, Mass.; Walter F. Reichardt, Little Rock, Ark.; Stuart A. Stephenson, Jr., New Brunswick, N. J. (Mr. Stephenson was elected as Junior if he consented at meeting of the board, Jan. 3, and has accepted classification.

CONTRACTING NEWS

OF SPECIAL INTEREST TO

CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS

OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Sansalito, Cal.—J. Richards, Ch. Engr. Springbank Water Works, writes that the costs of the proposed water works improvements are not yet estimated; bids will probably be called for in the summer.

Ft. Collins, Colo.—Myron Akin, of Ft. Collins, is reported to have received word from W. Hibbard, of St. Joseph, Mo., to the effect that enough capital has been interested in the Lincoln Lake reservoir and Laramie River tunnel proposition to insure its early completion. It is estimated that $350,000 will be required to complete this irrigation system. The tunnel will be about 2 miles in length and have a carrying capacity of 200 cu. ft. per second. A ditch connecting the Lincoln Lakes with the tunnel will also be built and an additional reservoir on the Victor Stewart Ranch in the Laramie River valley with a capacity of 500,000,000 cu. ft.

Loveland, Colo.—The Ryan Gulch Reservoir Co. has been incorporated, with a capital of $100,000, by David Hershman, John Hahn, J. M. Cunningham and others, to take water from Ryan gulch, a tributary of the Big Thompson. Principal office to be at Loveland.

New Haven, Conn.—The New Haven Water Co. is stated to have decided at its annual meeting, to construct a new reservoir in Woolbridge ravine.

Ft. DuPont, Del.—Bids will be received by Capt. Louis F. Garrard, Jr., Q. M., U. S. A., Delaware City, on March 8 for the extension of the water main at Ft. DuPont, as advertised in The Engineering Record.

Apopka, Fla.—It is reported that the Apopka Water & Light Co. will purchase equipment for a water plant.

**Jacksonville, Fla.*—Hugh Partridge, of Jacksonville, has secured the contract for sinking a 10-in. artesian well for $3,200, and the Lydnor Pump & Well Co., of Richmond, Va., secured the contract for a triplex pump for $1,525 (bids opened Feb. 6).

Chicago, Ill.—The Council Finance Committee is reported to have under consideration the petition of the High Pressure Water Comn. (Alderman Palmer, Chmn), for the installation of a high pressure water system for better protection. It was estimated that the following appropriations would be necessary to install a high pressure system: South Side, $450,000; West Side, $200,000; North Side, $175,000; pumping station, $125,000, and 22d St. lumber district, $151,000.

Columbus, Ind.—Geo. Vorwald, City Clk., writes that the lowest bid opened on Feb. 2 for furnishing two 150-h.p. boilers with foundations, smokestack, etc., was submitted by Benefiel Bros., of Columbus, for $3,042.

Yorktown, Ind.—A company is reported formed by Marvin B. Case, Daniel F. Cox and Saml. E. Hensley to construct water works; capital, $5,000.

Shirley, Ind.—See "Power Plants, Gas and Electricity."

Morristown, Ind.—The Town Trus. are reported to have in contemplation the construction of water works.

Iowa Falls, Ia.—Bids will be received by F. E. Foster, City Clk., March 6, for furnishing all tools, labor and material necessary to construct a complete pumping plant for the water works.

Ottawa, Kan.—Local press reports state that an ordinance is to be introduced in Council providing for the construction of water works.

Lacrosse, Kan.—See "Power Plants, Gas and Electricity."

**Owensboro, Ky.*—The U. S. Cast Iron Pipe & Fdry. Co., Chattanooga, Tenn., is reported to have secured the contract for furnishing pipe for the municipal water works, for about $70,000.

Baltimore, Md.—The Improv. Committee on Water (Mr. Wachter, Chmn.) is stated to have submitted a report in which is included the following recommendations: That $25,000 be appropriated to the Water Bd. for surveys and estimates, with a view of acquiring property on Gunpowder watershed to prevent pollution; that a water loan be authorized by Legislature to carry out a systematic plan for the enlargement and purification of the water supply; that storage reservoirs be constructed above Loch Raven to catch and retain surplus water; that the Water Bd. be furnished funds with which to erect about 700 additional fire plugs, and that the best expert talent be employed to make an examination and report on the best plant for the enlargement and purification of the water supply.

**Brockton, Mass.*—H. Kingman, Supt. Water Wks., writes that contracts for water pipe (bids opened Feb. 3) have been awarded as follows: To J. H. Cunningham Co., 269 Congress St., Boston, for water service pipe (price per 100 ft.) 15,000 ft. 1-in., $3.53; 4,000 ft. 1¼-in., $4.80; 2,000 ft. 1½ in., $5.80, and 8,000 ft. 2-in., $7.70; and to the Lynchburg Fdy. Co., 220 Broadway, for pipe for construction work, 1,500 length of 6-in., $26.95 per 2,000 lbs., and 250 length of 10-in., $26.45 per 2,000 lbs.

Springfield, Mass.—The State Bd. of Health has submitted its report to the city, treating the recommendations of the Special Water Comn. for the further development of the Ludlow water supply. The Board recommends further investigation. It states that it might be practicable to get a larger supply from Swift River, but recommends the investigation of the water supplies of the Huntington River branches, or of the Westfield Little River.

West Springfield, Mass.—The Water Comrs. are stated to have been authorized to petition Legislature for permission to issue additional water bonds to the amount of $50,000, to extend and develop the Bear Hole water supply.

Holden, Mass.—Henry W. Warren, Chmn. Water Comrs., writes that specifications are now being prepared for laying about 6 miles of c. i. pipe, and they will later on be sent to contractors on application.

Kalamazoo, Mich.—Local press reports state that the following are the bids recently received by Council for the season's supply of water pipe (price given per ton): R. G. Wood & Co., $29.75; the Massillon Iron & Steel Co., $27; M. J. Drummond & Co., $27.50; Wheeler & Pitkin, $26; American Car & Fdry. Co., $23.85 at Detroit, or $25.25 on cars at Kalamazoo; J. B. Powell & Sons, $26.95, and the U. S. Cast Iron Pipe & Fdry. Co., $24.95.

Grand Rapids, Mich.—Estimates have been prepared for going up the river about 3 miles for an improved water supply. The matter is now being considered by the Bd. of Pub. Wks. and will probably be submitted to the people the coming spring. L. W. Anderson, City Engr.

St. Paul, Minn.—The committee on mains of the Water Board has reported favorably on 7,090 ft. of 6-in. mains and 912 ft. of 12-in. mains to be laid this year.

Hibbing, Minn.—See "Power Plants, Gas and Electricity."

Jackson, Miss.—Press reports state that if the Jackson Water Works Co. will secure a new franchise, it will make improvements and install a filter plant.

St. Louis, Mo.—An expenditure of $800,000 was provided for in 3 Water Dept. ordinances which have been approved by the Bd. of Pub. Improv. One is for a 7-ft. steel flow line from the Chain of Rocks to Baden, to cost $600,000, another for $160,000 worth of plugs, pipes and valves, and the third for $40,000 for new pipe.

Highlands, N. J.—See "Power Plants, Gas and Electricity."

Perth Amboy, N. J.—The Bd. of Water Comrs. are stated to have on Feb. 1 adopted plans for a $35,000 pump to be installed at Runyon, with a daily capacity of 8,000,000 gal.

New York, N. Y.—The Aqueduct Comn., on Feb. 7 approved the maps and plans for the new reservoir and dam at Cross River, about 3,000 ft. east of New Katonah, and sent them to the Corporation Counsel with a request that he advertise them at once with the Supreme Court, in Westchester, and ask for the appointment of a commission to condemn the land.

Albany, N. Y.—The Assembly has passed the bill authorizing this city to issue $400,000 bonds to extend the filtration plant.

Medina, N. Y.—The citizens are reported to have voted Jan. 31 to bond the village for $100,000 for municipal water works.

Buffalo, N. Y.—The State Senate has passed the bill to allow this city to issue $500,000 bonds for water works improvements.

The Park Comrs. have surrendered the property between the lake and canal, south of Porter Ave., to be used as a site for a pumping station. This is one step toward the rebuilding of the water system. The total cost of the water system, as estimated by Francis G. Ward, Comr. Dept. of Pub. Wks., will be about $1,500,000. He bases his estimate on the following items: New inlet pier and tunnel, $300,000; new building, $150,000; conduits, wells, foundations and air pumps, $150,000; two new pumping engines, $200,000; rebuilding old station, $100,000; reinforcing city water mains, $500,000, and incidental expenses, $100,000.

Syracuse, N. Y.—Bids will be received Feb. 14 by the Bd. Contract and Supply for furnishing 365 tons 6, 8, 10 and 12-in. coated c. i. water pipes, and 9 tons special castings. Fred. T. Pierson, Clk.

Graham, N. C.—See "Power Plants, Gas and Electricity."

Oxford, N. C.—See "Power Plants, Gas and Electricity."

Andrews, N. C.—See "Power Plants, Gas and Electricity."

Toledo, O.—The State Bd. of Health has approved the plans for the new filtration plant as prepared by Chas. S. Parmelee, Consulting Engr. Bids for construction will soon be received.

Cleveland, O.—Bids will be received by the Bd. of Public Service on Feb. 24 for furnishing and delivering all water meters that may be required by the water works division during the year 1905, as advertised in The Engineering Record.

Columbus, O.—The Bd. of Pub. Service is stated to have recommended to Council the purchase of land on Scioto River above the present west side pumping station, and running north to the intake, as a site for the new filtration and softening plant.

**Items marked thus give the names of parties awarded contracts.*

North Amherst, O.—The Council is reported to be considering the question of establishing water works.

Fostoria, O.—J. H. Twining, Supt. Water Wks., writes that it is proposed to construct a new filter basin (old one to be renewed), the filter to be of sand type, repair clear-water basin, to be of concrete instead of rip rap as at present, at a total cost of $40,000.

Lakewood, O.—The Rocky River Water, Light & Power Co. is reported formed for the purpose of installing a filtration plant. H. J. Sensel, Village Clk.

Portsmouth, O.—Engr. L. E. Chapin, of Pittsburg, Pa., is reported to have completed plans for rebuilding the water works; he estimates the cost at $242,000. Capt. J. W. Smith, Chmn. Water Com. F. Musser, City Aud.

Ft. Reno, Okla. Ter.—Bids are wanted March 3 for constructing and erecting a 60,000-gal. wooden tank and trestle at this post. Robt. H. Stevens, Ch. Q. M., U. S. A., San Antonio, Tex.

Altoona, Pa.—The city is stated to have purchased property on Rigel's Run, north of Elizabeth Furnace, to be used as a site for a reservoir.

Tremont, Pa.—The Citizens' Water Co., of Tremont, has been incorporated, with a capital of $5,000 by G. M. Roads, of Pottsville, and R. S. Bashore, of Tremont, for the purpose of supplying water to Tremont and vicinity from Black Creek.

Philadelphia, Pa.—The following are the bids opened by Peter E. Costello, Dir. Dept. Pub. Wks., Bureau of Filtration, for coal handling machinery and pockets for Lardner's Point Pumping Stations, Nos. 2 and 3; (*a*) coal handling machinery, cable railway, steel bents, bridge, permanent way, hoisting machinery, towers, booms, shovels, hoppers, etc., complete; (*b*) coal handling machinery, etc., with timber bents; (*c*) coal storage pockets of 5,000 tons capacity of steel reinforced concrete, complete; (*d*) coal storage pockets, etc., of structural steel; (*e*) coal storage pockets, etc., of timber lined with steel; (*f*) railway track, switches, weighing scale, etc., from pockets to entrance of boiler house, complete; (*g*) railway track, switches, etc., in the boiler house of Lardner's Point Pumping Station No. 3; (*h*) double side dump charging cars of one (1) ton capacity, complete, ea.; (*i*) wharf: Millard & McGraw Constr. Co., 1010 Arcade Bldg. (time limit, 10 mos.), *a*, $47,500; *b*, $43,500; *c*, $60,000; *d*, $60,000; *e*, $55,000; *f*, $4,000; *g*, $1,000; *h*, $150; *i*, $9,000. Henderson & Co., 1212 Arch St. (time limit, 240 wk. days), *a* (5 bids), $35,000 to $54,000; *b* (5 bids), $32,200 to $51,200; *c* (2 bids), $64,000 and $59,000; *d* (2 bids), $64,307 and $62,700; *e*, $37,700; *f* (3 bids), $3,800, $4,300 and $7,000; *g* (3 bids), $500 to $1,028; *h* (3 bids), $130 to $185; *i*, $9,987. The Snare & Triest Co., 39 Cortlandt St., New York, N. Y. (time limit, 9 mos.), *a*, $39,980; *b*, $34,400; *c*, $58,600; *d*, $60,980; *e*, $52,300; *f*, $8,300; *g*, $1,200; *h*, $1,400 *i*, $8,200. David People, 1000 Betz Bldg. (time limit, 8 mos.), *a* (2 bids), $43,700 and $47,700; *b* (2 bids), $42,000 and $45,200; *c*, $55,000; *d*, $65,000; *e*, $42,000; *f*, $5,000; *g*, $650; *h*, $100; *i*, $7,500. Edw. T. Fonder, 1116 Land Title Bldg. (time limit, 18 mos.), *a* (2 bids), $48,170 and $50,170; *b* (2 bids), $46,170 and $48,170; *c*, $66,000; *d* (2 bids), $87,906 and $89,906; *e*, $54,206; *f*, $8,005; *g*, $967; *h*, $150; *i*, $6,882. The Schofield Co., 906 Pennsylvania Bldg. (time limit, 10 mos.), *a*, $89,000; *b*, $87,000; *c*, $78,000; *d*, $76,500; *e*, $72,000; *f*, $11,400; *g*, $1,190; *h*, $170; *i*, $14,600.

Greensburg, Pa.—J. A. Strickler, of Wilkinsburg and J. N. Kuhns, of Greensburg, are directors of the Veteran Water Supply Co., recently formed, and the company has secured a reservoir site on Baker Run, north of Armbrust.

Blandburg, Pa.—A charter has been granted to the Blandburg Water Co., of Blandburg, for the purpose of supplying water for the public in the township of Reade. Incorporators: Fred. Bland, Sr., of Tipton, Pa., treasurer, and G. C. Bland and Fred. Bland, of Blandburg.

Pittsburg, Pa.—Plans and specifications for the construction of the proposed filtration system, bids to be opened March 8, as advertised in The Engineering Record, can be seen at the office of The Engineering Record, 114 Liberty St., Room 607.

Manning, S. C.—E. J. Browne, Town Clk. and Treas., writes that there is a movement on foot here looking to the construction of water works and a sewerage system. No definite action taken as yet.

**Deadwood, S. D.*—Hanley & Ritchie, of Iola, Kan., are stated to have secured the contract for constructing water works (bids opened Jan. 23) for $116,900.

Cookeville, Tenn.—See "Power Plants, Gas and Electricity."

Seattle, Wash.—Bids will be received by C. B. Bagley, Secy. Bd. Pub. Wks., until Feb. 18, for the following work: For the Phinney Ave. water main to cost about $34,900, to consist of 9,125 lin. ft. 16-in. machine banded wooden pipe, 22,325 lin. ft. 8-in. machine banded wooden pipe, 1,075 lin. ft. 2-in. wrought iron galvanized pipe, 8 16-inch gates, 31 8-in. gates, 10 2-in. gates, 39 valve boxes, 8,400 lbs. special castings; grading Wallingford Ave. at a cost of $51,500, and for a sewer and septic tank on Tenth Ave., N. E., at a cost of about $10,500.

Colville, Wash.—W. H. Jackson, Town Clk., writes that bids will be received on Feb. 28 for the purchase of $12,000 water bonds. W. L. Bowen is acting as engineer.

Menasha, Wis.—Bids are wanted Feb. 23 for pumping machinery, pipe, hydrants, valves, material and supplies for any and all parts of a system of water works, as advertised in The Engineering Record.

East Toronto, Ont.—It is stated that bids are wanted Feb. 20 for furnishing material and erecting a reinforced concrete pumping station. Engineer, John Galt, of Toronto.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

**Denver, Colo.*—Contracts for constructing storm sewers in Capitol Hill Storm Sewer Dist. No. 1 are stated to have been awarded as follows: To Gaffy & O'Keefe for Sub-districts Nos. 8 and 9, for $28,901, and to the Denver & Pueblo Constr. Co., for Sub-districts Nos. 13 and 14, for $12,128.

Washington, D. C.—Bids are wanted March 6 for constructing twin siphons of the sewage disposal system crossing Anacostie River in the District of Columbia, as advertised in The Engineering Record.

**Washington, D. C.*—The following are the bids opened on Jan. 30 by the District Comrs (D. E. McComb, Supt. of Sewers) for constructing a portion of the sewage disposal system, trunk sewers and connections, including sewage conduits and twin sewers in the District; (*a*) J. H. Louchheim, (*b*) Gayer, Peter, Constr. Co., (*c*) E. G. Gummel, (*d*) Edmund Saxton, (*e*) Sullivan Bros., (*f*) J. Connelly Constr. Co.:

		a.	**b.*	*c.*	*d.*	*e.*	*f.*
10,420	cu. yd. excavation	$1.56	$1.00	$1.25	$1.75	$1.64	$1.10
98	" brick masonry	13.00	14.00	16.00	15.40	13.00	13.50
153	" vitrified brick masonry	19.50	18.00	28.00	21.40	22.00	22.00
1,365	" concrete "B"	9.50	7.75	8.00	9.20	7.60	10.10
1,000	" concrete "C"	9.50	7.25	7.75	8.60	7.10	9.90
563	lin. ft. 6-in. under drain	.25	.50	.50	.20	.25	.30
563	" 12-in. pipe sewer	.50	.60	.90	.30	1.00	1.50
	Totals	$43,208	$32,761	$37,986	$44,341	$39,519	$40,269

**Palatka, Fla.*—The following are the bids opened on Feb. 1 by the Bd. of Bond Trus., for the construction of a sewerage system (Engineer, Wm. W. Lyon, of Tallahassee); (*a*) J. H. Clements, Jr., Schenectady, N. Y.; (*b*) G. A. Tenny, Spartanburg, S. C.; (*c*) Guild & Co., Chattanooga, Tenn. (awarded contract); (*d*) Wm. T. Cotter, Jacksonville; (*e*) Bryan & Co., Jacksonville; (*f*) The Allison Co., Birmingham, Ala.; (*g*) Chas. S. Ferguson, Lorain, O.; (*h*) F. H. Beaman, Tallahassee:

	a.	*b.*	**c.*	*d.*	*e.*	*f.*	*g.*	*h.*
Excav. and backfill:								
6,500 ft. not over 4 ft.	$0.12	$0.10	$0.17½	$0.35	$0.24	$0.30	$0.30	$0.16
25,000 " " " 6 "	.33	.30	.25	.65	.33	.50	.42	.24
21,000 " " " 8 "	.49	.40	.40	.95	.53	.62	.48	.35
3,685 " " " 10 "	1.03	.60	.75	1.35	.69	.78	.60	.48
1,000 " " " 12 "	1.15	1.00	1.10	1.75	.88	1.02	.71	.90
Pipe sewers:								
6,264 ft. 6-in.	.14	.11	.08	.09½	.10	.10	.22	.12
35,380 " 8-in.	.20	.15	.12	.14	.12½	.15	.25	.16
11,336 " 10-in.	.27	.21	.16	.19½	.17½	.20	.30	.21
2,700 " 12-in.	.37	.27	.23	.25	.23	.25	.34	.28
1,465 " 15-in.	.51	.39	.30	.36	.35	.35	.43	.38
Branches:								
62 6-in.	.32	.25	.17	.16½	.25	.38	.30	.21
450 8-in.	.51	.30	.25	.25	.40	.57	.45	.31
225 10-in.	.62	.45	.38	.36	.60	.80	.65	.40
40 12-in.	.96	.60	.45	.47	.75	1.20	.84	.50
20 15-in.	1.41	.80	.75	.69	1.00	1.75	1.24	.65
Manholes:								
12 not over 4 ft. deep	25.00	25.00	25.00	28.00	25.00	25.00	25.00	29.00
50 " " 6 " "	33.00	30.00	27.00	33.00	27.50	35.00	30.00	35.00
56 " " 10 " "	48.00	35.00	33.00	39.00	30.00	45.00	35.00	39.00
4 " " 12 " "	75.00	40.00	45.00	50.00	35.00	55.00	40.00	43.00
10 lampholes, 7 ft. deep	6.14	20.00	8.00	10.00	7.50	10.00	10.00	8.00
30 flush tanks	73.00	65.00	60.00	60.00	50.00	60.00	75.00	65.00
Laying cast-iron pipe:								
240 lin. ft. 8-in.	.15	.25	.20	.20	.10	.25	.50	.35
60 " 10-in.	.23	.30	.25	.30	.15	.35	.50	.40
36 " 12-in.	.30	.40	.30	.40	.25	.50	.50	.40
72 " 16-in.	4.00	2.00	2.50	.75	1.25	.75	2.00	5.50
Totals	$45,076	$36,028	$33,329	$59,668	$38,106	$47,575	$47,931	$34,442

West Lafayette, Ind.—Prof. C. V. Seastone, Town Engr., is reported to be preparing plans for a complete system of sewers for West La Fayette. The system will include storm water sewers for University Park addition, and sanitary sewers for the remainder of the town.

**Cresco, Ia.*—W. L. Richards, Chmn. St. Com., writes, in regard to the construction of 6,270 ft. 8 in. vitrified pipe sewers, bids for which were opened on Feb. 1, that O'Farrell & McNamara, of Dubuque, were the successful bidders for one-third of the work, and Geo. Warner, of Cresco, for the balance.

Perry, Ia.—M. A. Earl, Consulting Engr., Chicago, Ill., writes that he is preparing plans for a sewerage system for Perry. Date of receiving bids not yet determined.

Sheldon, Ia.—A $33,000 sewer system has just been planned for Sheldon by J. B. Frisbee, of Des Moines. The system comprises a septic tank, alternately discharging upon two sand filter beds, and about 27,000 ft. of pipe sewers. The plans are on file with G. T. Wellman, City Clk.

Boston, Mass.—The Bd. of Aldermen on Feb. 6 passed the $800,000 loan order for the construction of sewers.

Fitchburg, Mass.—The construction of a main intercepting sewer and filtration area will probably be commenced this season, but owing to desired legislative action, no work will be attempted for 4 months at least. Detailed plans and specifications have not yet been prepared. David A. Hartwell is City Engr.

Coldwater, Mich.—Chas. G. Moore, City Engr., writes that all bids opened on Jan. 26 for the construction of sanitary sewers, have been rejected, as all were in excess of the estimate, and new bids will be received on Feb. 21. The lowest bid received amounted to $28,662. For list of detailed bids received for this work, see issue of The Engineering Record, Feb. 4.

Lansing, Mich.—All bids opened on Jan. 30 for constructing brick and pipe sewers in Pine, Madison and other streets, have been rejected. Plans will be modified and new bids received. The lowest bid received was that of John H. Algate, of Lansing, for $24,437.

Kirkwood, Mo.—R. M. Douglass, 503 Fifth Ave., Pittsburg, Pa., is engineer for the proposed sewerage work at Kirkwood. Chas. G. Recker, Mayor.

Seward, Neb.—The Commercial Club is reported interested in the construction of a sewerage system.

Manchester, N. H.—The following estimate of the appropriations required by the Street & Park Comrs. (Fred. Ramsey, Clk.) for the year 1905 has been presented to Common Council: Sewers, $25,000; bridges, $10,000; new paving and repairs, $49,000.

Laconia, N. H.—F. G. Berry, City Engr., has been authorized to prepare plans for sewers and disposal works for the section of the city known as The Weirs.

Elizabeth, N. J.—W. H. Luster, Jr., City Surveyor, has completed a report providing for the drainage of the western part of the city.

Jersey City, N. J.—Geo. T. Bouton, Clk. St. and Water Bd., writes that the lowest bid opened on Feb. 6, for constructing a circular brick relief sewer in a portion of Fairmont Ave., was submitted by J. H. & R. Shannon Co., 538 Bergen Ave.

New York, N. Y.—Bids will be received Feb. 15 by John F. Ahearn, Pres. Boro. Manhattan, for furnishing material and constructing sewer and appurtenances in portions of Norfolk and W. 135th Sts. Engineer's estimate: 519 lin. ft. 3-ft. 6-in.x2-ft. 4-in. brick sewer, 991 lin. ft. 15-in. salt-glazed vitrified stoneware pipe sewer, 400 cu. yds. rock excav., etc.

Bids will be received by the Comrs. of Parks (John J. Pallas, Pres.), until Feb. 23, for constructing a pipe sewer from the pavilion in DeWitt Clinton Park to the city sewer in West 54th St.

Ft. Michie, N. Y.—Capt. E. F. Ladd, Q. M., U. S. A. writes that the lowest bid opened on Feb. 4 for constructing a sewer at this post was submitted by E. J. Sica, of Fisher's Island.

Toronto, O.—The People's Sanitary Sewerage Co., of Toronto, has been incorporated, with a capital of $10,000, by L. H. Hilsinger, T. C. Weir, Jesse Gilcrest and others.

South Brooklyn, O.—Bids are wanted Mar. 13 for $11,070 bonds to be used for constructing sanitary storm water sewers in portions of Pearl St., Bleise and Arthurdale Aves. W. T. Pupikofer, Village Clk.

Columbus, O.—The Bd. of Pub. Service is reported to have recommended to Council an ordinance authorizing the Board to procure bids for the main sewage plant pumping station, estimated to cost about $64,000.

**Lima, O.*—T. J. Mulligan is stated to have secured the contract for constructing a brick sewer, 36-in. diam., in High St., at $4.86 per lin. ft.

Ravenna, O.—S. J. Post, Village Clk., writes that it is proposed to construct vitrified tile sewers at a cost of $80,000. Engineer, W. E. Myers, of Kenton.

Harrisburg, Pa.—M. B. Cowden, City Eng., writes that no election will be held this month, nor this spring, for the issue of $100,000 bonds for improving the sewerage system, as the ordinance necessary to place the question before the people has been defeated.

Altoona, Pa.—Plans are being prepared for sewers in connection with the annexation to the 9th Ward, an area of 122 acres. Harvey Linton, City Engr.

**Philadelphia*, Pa.—Contracts for constructing sewers were awarded on Feb. 1 by Peter E. Costello, Dir. Dept. Pub. Service, as follows: Pratt St. sewer to David McMahon, E. Chelten Ave., Germantown, for $80,000; Magee St. sewer to David Peoples, 2649 W. Thompson St., $70,000; and reconstruction of Cohocksink sewer in Girard Ave. and Front St. to J. H. Louchheim & Co., 329 Mint Arcade Bldg., for $40,000.

Chattanooga, Tenn.—The House has p a bill authorizing the city to issue $15 bonds for building sewers and opening st

Manning, S. C.—See "Water."

Seattle, Wash.—See "Water."

Toronto, Ont.—City Engr. Rust estim the cost of a sewerage system in the end at about $24,000.

BRIDGES.

Notes Arranged Alphabetically by Stat

Roosevelt, Ariz.—See "Miscellaneous."

San Bernardino, Cal.—It is stated bids will be received March 13 by the Co. Superv. for constructing a bridge San Timoteo Creek, at Redlands Junction A. Pfeiffer, Co. Clk.

South Norwalk, Conn.—The following are stated to have been received for structing a stone arch bridge at Belle Isl Dudley E. Hoyt, of South Norwalk, $7 John Fanzilla, South Norwalk, $11 Standish Stone Co., of Bridgeport, $11 Smith & Robertson, of New York, $12 F. Long Co., of Hackensack, N. J., $14 Fredk. Wardwell, of Stamford, $14,256; & Larkin Co., of Derby, $15,000, and the Engineering & Constr. Co., of New York $19,056.

Emericksville, Ind.—H. W. Klausman Indianapolis, County Surveyor, writes plans have not yet been completed for structing a bridge over White River Emericksville.

Des Moines, Ia.—Local press reports that bids will be received until Feb. 16 b Bd. Pub. Wks., for constructing an exte to the South Des Moines bridge, the cost about $4,000.

Iowa Falls, Ia.—The Commercial Cl reported to be investigating the cost of structing a steel or cement wagon and bridge across Iowa River at Iowa Falls.

Amite City, La.—It is reported that will be received March 6 by Tangipahoa ish Police Jury for removing and reconst ing steel bridge over Tangipahoa River, Davies Ferry Crossing.

Bangor, Me.—There is some talk of structing a steel draw bridge across the duskeag at the foot of Exchange St.

Ionia, Mich.—The Massillon Bridge C Massillon, O., is stated to have submitte lowest bid, Feb. 2, for constructing the land St. Bridge; their bid was $11,950.

St. Paul, Minn.—See "Paving and making."

Lexington, Mo.—The House of Repres tives is stated to have passed a bill au izing the construction of a bridge over Missouri River at Lexington.

Manchester, N. H.—See "Sewerage Sewage Disposal."

Buffalo, N. Y.—Bids will be received Feb. 22 by the Dept. of Pub. Wks., (Fr G. Ward, Comr.), for furnishing materia constructing the substructure of a ba bridge at Ohio St., across Buffalo River.

Syracuse, N. Y.—It is proposed to cons a bridge across the Oswego Canal at W st.; span, 70 ft.

Gouverneur, N. Y.—The construction steel plate girder bridge over Oswega River at Main St., is reported under co eration; estimated cost, $18,000.

**Binghamton, N. Y.*—D. C. Herrick, Clk., writes that the contract for repa Tompkins St. Bridge (bids opened Feb. 7 been awarded to the Owego Bridge Co Owego, for $1,950.

Valley City, N. D.—Bids will be receiv the Co. Comrs. until Mar. 4 for construct steel bridges, one 120-ft. span, and one span. T. M. Gunderson, Co. Aud.

Piqua, O.—Fred. J. Green, of Spring Vice-Pres. Springfield, Troy & Piqua Tra Co., writes that bids will be received on 15 for the construction of a bridge Miami River; probable cost, $12,000.

Youngstown, O.—There is some talk of constructing an overhead bridge from St. to Federal St. F. M. Lillie, City En

Cincinnati, O.—Bids will be received M 8 by the Co. Comrs. for $25,000 Benso bridge bonds. Geo. C. Zimmermann, Cl

Akron, O.—Plans are stated to have prepared for the North Hill Viaduct, structure to be 2,700 ft. long, with 27-ft. way and a 5-ft. sidewalk. According t ports, the Northern Ohio Traction & Co. will pay one-half and the city and co will pay the other half of the estimated $215,000.

Harrisburg, Pa.—The Bd. of Pub. & Grounds are stated to have approved plans prepared for rebuilding the Ber Nescopeck River Bridge, at an estimated of $85,000; also for a bridge over Cata Creek at the paper mill, estimated $55,000. According to reports, the cont will soon be let.

Fayetteville, Pa.—The House of Repr tatives is stated to have passed a bill au izing the construction of a bridge over ongahela River.

Altoona, Pa.—The engineers of the P sylvania R. R. Co. (W. H. Brown, Ch E. Philadelphia) are preparing plans for a bridge, 168-ft. span, over the tracks o Pennsylvania R. R. at 7th St. The cost be divided between the city, the Pennsyl R. R. and probably the City Passenger Ry Harvey Linton, City Engr.

Items marked thus give the names of parties awarded contracts.

shville, Tenn.—The. construction of a e over New Cumberland River in David- County, at a probable cost of $500,000, is ted under consideration.

oxville, Tenn.—The City, the Louisville ashville Ry., the Southern Ry. and the ville Traction Co. are preparing to con- t a concrete viaduct on Clinch Ave., 700 ng. T. J. Moreland, City Engr.

oldendale, Wash.—It is stated that bids be received April 4 by A. M. Macleod, Co. , for constructing a 120-ft. span combina- bridge over Klickitat River; also for con- cting a 180-ft. trestle approach to same.

Spokane, Wash.—The following bids are ed to have been received for constructing Olive St. bridge: Wm. Oliver, $10,300; Bailey & Co., $9,400; J. J. Walsh, $11,- ; A. L. Snow, $10,340; Zerngible & Mar- l, $8,385 (awarded contract); Van Nor- & Oliver, $9,950, and the Portland ige & Bldg. Co., $8,500.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—Tryon & Brain, Byrne g., are stated to have received the contract improving Santa Fe Ave., for $18,100.

Savannah, Ga.—Bids will be received Feb. by the Streets and Lanes Com. for fur- ning said city f.o.b. cars or wharf about 000 sq. yds. vitrified paving brick. Geo. Gadsden, Dir. Pub. Wks.

Springfield, Ill.—Contracts for paving e been awarded as follows: To Barber phalt Co. for asphalt on 44th St., at $2.18 sq. yd., and to John E. Bretz for paving rence and Enos Aves., at $1.47½ per k paving and 54 cts. per lin. ft. for curb; al cost of both contracts, about $80,000.

Chicago, Ill.—The Bd. of Local Improve- nts is stated to have approved orders for paving of the following streets: 24th, 1, Morgan, Lexington, Johnson, Division, gusta, N. Clark and Whipple Sts., Wabash, we, Sacramento, S. Oakley, 5th, S. Central rk, Hoyne and Francisco Aves., and Buck- ham Pl., at an estimated cost of $592,500. The Bd. of Local Improvements is stated have awarded the following contracts for eet improvements: Dearborn, St. Louis es. and 15th St., with asphalt, to the Bar- Asphalt Paving Co., Stock Exchange Bldg., $15,579, $22,544 and $39,360, respect- ly; Elizabeth St., with granite macadam, Farr Bros. Co., for $26,635.

Indianapolis, Ind.—Plans are stated to ve been prepared for constructing Pleasant n Boule., from Raymond to Beecher St., an estimated cost of $18,500.

Peru, Ind.—It is stated that bids will be eived Feb. 23 by Clarkson W. Macy, Co. ud., for constructing roads in Harrison wnship; in all, about 18½ miles.

Broad Ripple, Ind.—Bids will be received arch 7 by the Town Bd. of Trus. for im- oving sidewalks with cement on portion of elby and North Sts. John O. Brenneman, lk.

**Baltimore, Md.*—Daniel Sullivan, Station , has secured the contract for grading, curb- g and paving a portion of Smallwood St. bids opened Jan. 25) at $2.47 per sq. yd. r granite block paving, including grading. . T. Fendall, City Engr.

Worcester, Mass.—The following are the bids pened on Feb. 2 by the Common Council for eflooring and paving 3d St. bridge over C. N. & N. P. Rys.: A. W. Van Hoeten, $10,489; as. Forrestal Co., $11,127; Fielding & Shep- ey, $10,320; W. J. Prendergast, $11,237, and . E. Sandeen, $11,487. The detail bid of Fielding & Shepley, the lowest bidder, is as ollows: 1,041 ft. bed plank, $3.30 per lin. t.; 3,500 sq. yds. paving, $1.85 per sq. yd.; 00 lin. ft. fence, 35 cts. per lin. ft., and emoving old floor, cleaning and painting, ump sum $200.

The Barber Asphalt Co. bid on Feb. 2 for epairing asphalt pavements during the year 905: For asphalt surfacing, $1.65 per sq. d., and for concrete foundation, $1 per q. yd.

The following bids were opened by Com- non Council on Feb. 2 for flagstones; (*a*) ranite; (*b*) Winona stone; (*c*) sandstone price given per lin. ft. 15 in. wide): Field- ng & Shepley, *a*, $1; *b*, 40 cts.; *c*, 37 cts. Siesanz Stone Co., *a*, $1.25; *b*, 38½ cts.; *c*, 4 cts. Thos. Manning, *b*, 47 cts.; *c*, 48½ ts. The bid of Fielding & Shepley for gran- te and sandstone was recommended for ward, and no contract was awarded for Winona stone.

Bids were opened same time and place for urnishing brick (price given per M.); (*a*) lock paving; (*b*) common paving; (*c*) sewer: . L. Bell, *a*, $22.50; *b*, $17.75. Thos. Man- ing, *a*, $21.75; *b*, $17; *c*, $9.20. St. Paul ime & Cement Co., *c*, $9.10.

Jas. Forrestal Co., of St. Paul, submitted he following bid on Feb. 2, for repairing aved streets (price given per sq. yd.): Cedar lock pav't repairing, 30 cts.; new cedar locks (4 in.) in pav't, 70 cts.; New cedar locks (5 in.) in pav't, 70 cts.; brick pav't re- air (without concrete), 60 cts.; new brick, ommon size, in pav't, $1.50; new brick, lock size, in pav't, $1.50; sandstone pav't without concrete) repaving, 65 cts.; new andstone blocks, set in pav't, $2.20; granite av't (without concrete) repaving, 65 cts.; ew granite blocks set in pav't, $2.20; con- rete found., 6 in. thick, 65 cts., and lumber er M. ft., $12.

St. Louis, Mo.—The following are the bids opened on Jan. 27 by the Bd. of Local Improv., for the paving of numerous streets; bidders of St. Louis, unless otherwise mentioned; (*a*) 2,121 cu. yd. grading; (*b*) 2,989 cu. yd. preparing roadbed or ground for superstructure; (*c*) 3,163 lin. ft. granite curb, 6x16-in., on concrete foundation; (*d*) 588 squares Portland cement concrete 6-in. deep; (*e*) 588 squares vitrified brick paving laid on sand base; (*f*) 10 squares macadam:

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	Total.
McIntyre & Teese Constr. Co.	$0.24	$0.24	$1.10	$8.70	$11.00	$1.00	$16,229
Ruecking Constr Co.	.24	.24	.95	10.00	9.00	4.00	15,443
Gottlieb Eyermann	.24	.24	.60	9.00	11.09	1.00	14,947
Wm. R. Bush Constr. Co.	.36	.36	.90	8.50	11.30	1.00	16,339
Gilsonite Constr. Co.	.30	.30	.95	8.00	12.50	1.00	16,602
Fruin & Colnon.	.35	.35	.90	10.00	9.50	4.00	16,141
The Parker-Washington, Co. of West Va.	.30	.30	.25	8.00	16.81	4.50	16,957
Skrainka Constr. Co.	.31	.31	.85	8.00	12.55	4.00	16,396

Manchester, N. H.—See "Power Plants, Gas and Electricity."

Wildwood, N. J.—It is stated that bids will be received Feb. 14 by Jed Dubois, Boro. Clk., for constructing or relaying cement curb and sidewalks; in all, about 125,000 sq. ft. sidewalk and 25,000 lin. ft. curb.

**Ocean City, N. J.*—Edward C. Corson is stated to have received the contract for street improvement in this city, for $15,000.

**Jersey City, N. J.*—Geo. T. Bouton, Clk. St. & Water Bd., writes that contracts for paving, bids opened Feb. 6, have been awarded as follows: To John Nolan, 108 Bergen Ave., for Plainfield Ave.; and to the Uvalde Asphalt Paving Co., 2 Greene St., for Orient Ave.

Geneva, N. Y.—Bids will be received Feb. 23 by the Bd. Pub. Wks., for paving with brick, macadam, tar macadam, asphaltic macadam and asphalt; requiring 29,600 sq. yd. pavement, 5,000 cu. yd. excav., 8,900 lin. ft. new curb, 1,650 lin. ft. old curb reset, 3,000 ft. storm water sewer tile, 10,540 ft. 3-in. drain tile, and 32 catch basins. The foundation for about 3,800 sq. yds. for said paving is Medina block to be taken up and relaid. W. S. Wood, Secy.

Syracuse, N. Y.—It is proposed to pave Butternut St. with brick, about 25 sq. yds.

Nyack, N. Y.—The Palisades & Stony Point Driveway Association, of Nyack, was incorporated Feb. 6 to promote the construction of one or more driveways, connecting the Palisades Interstate Park with the State reservation at Stony Point. Directors: Wm. B. Conrad, Wm. Duryea and Irving Hopper, of Nyack, and others.

New York, N. Y.—Bids will be received Feb. 15 by John F. Ahearn, Pres. Boro. Manhattan, for regulating and repaving with asphalt portions of numerous streets. Engineer's estimate: 40,280 sq. yds. asphalt, including binder course; 33,740 sq. yds. old stone pavement relaid as foundation or in approaches, etc.; 18,800 lin. ft. new bluestone curb, furnished and set; 1,315 lin. ft. old bluestone curb, redressed, rejointed and reset, etc.

Brooklyn, N. Y.—Bids will be received Feb. 23 by Martin W. Littleton, Boro. Pres., for regulating and repaving with asphalt portions of Atlantic Ave. and Lorimer St., and for regulating and paving with asphalt a portion of 80th St.; also for regulating, grading, curbing, guttering and laying sidewalks on portions of several streets; for repairing and maintaining asphalt pavements on various streets in Boro. Brooklyn; for constructing cement concrete sidewalks on a portion of 92d St. Engineer's estimate, 85,183 sq. yds. asphalt, 12,984 cu. yds. concrete, 7,543 cu. yds. earth excav., 24,770 lin. ft. new curb., 253,300 sq. ft. cement sidewalks, 3,000 sq. yds. asphalt, including binder course, in plumbers' cuts; 55,000 cu. ft. asphalt wearing surface, delivered and laid in place of old wearing surface destroyed or removed; 12,000 cu. ft. asphalt wearing surface, delivered and laid in repairing surface defects by burner method; 13,100 sq. ft. cement concrete sidewalk, etc.; bids will also be received on same date for furnishing and delivering 17,867 cu. yds. broken trap rock, and 5,961 cu. yds. trap rock screenings.

Buffalo, N. Y.—The German Rock Asphalt Co., D. S. Morgan Bldg., was stated to have submitted the lowest bids Feb. 1 for paving with asphalt portions of the following streets: Park St., $2,742; Amherst St., $6,768; William St., $2,010, and Eagle St., $6,314.

Rochester, N. Y.—The lowest bids received for paving 1st St. are stated to have been submitted by H. N. Cowles, 47 Tacoma St., for brick, $26,310, and Whitmore, Rauber & Vicinus, 279 South Ave., for asphalt, $26,-168.

Cleveland, O.—The following are the bids opened on Feb. 1 by the Bd. of Public Service for paving numerous streets: Baldwin Bros. & Graham, bid for Heath St., $9,626; Northern Ohio Paving & Constr. Co., for Hurlburt St., $5,017; Nora St., $8,470; Everett St., $8,190; Renney St., $5,393; Kinsman St., $14,491. Roehl Bros., for Higgin St., $10,-146; Clover St., $5,095; Liberty St., $7,389; Tracey St., $6,931; Aiken St., $5,188. Cleveland Trinidad Paving Co., for Ravine St., $10,363; Higgin St., $10,136. John F. Brennan, for Wason St., $12,127; Kelley St., $5,485. Frank Orlikowski, for College St., $6,941.

Bids will be received Feb. 21 by the Bd. Pub. Service for grading, draining, curbing and paving with dressed block Medina stone, portions of Broadway, Marquette and Flint Sts.; also for grading, draining, curbing and paving with common Medina stone a portion of Lorain St., and with tar macadam a portion of Bellflower Ave. A. R. Callow, Secy.

**Piqua, O.*—Kelley Bros., of Portsmouth, are stated to have secured the contract for paving Wood St. with vitrified brick, on concrete foundation; cement curb and gutter, Townsend block being used; amount of contract, about $22,000.

**Columbus, O.*—Kelley Bros., of Portsmouth, are stated to have secured the contract of paving the B. & O., S. W. R. R. train sheds at Columbus with Bolin block on concrete base; contract price about $24,000.

**Cincinnati, O.*—Contracts for macadam pavement (bids opened Feb. 1) have been awarded as follows: Observatory Ave., Delaney & Goddman, $44,827, and Oliver St., Wm. Fogarty, 5,800 sq. yds. at $1.12, or a total of $13,890.

It is proposed to pave the following streets with bitulithic: North Crescent St., at a cost of $29,000; Washington Ave., $26,000; Hopkins St., $33,000, and Ringgold St., $16,000.

Bids will be received March 3 by the Bd. Pub. Service for furnishing material and resurfacing with asphalt a portion of 8th St.; also on same date for grading, curbing and paving with brick a portion of Fergus St. Geo. F. Holmes, Clk.

**Toledo, O.*—The Bd. of Pub. Service is stated to have awarded on Feb. 2 contracts for paving portions of streets as follows: Norwood Ave. and Huron St. with Logan block, to Kerlin Bros. Co., 416 Nasby Bldg., at $16,657 and $5,696 respectively; Vermont Ave., with Massillon block, to O'Sullivan & Sheehan, at $8,239; Summit St., with Medina block, to Thos. McKinney & Son, The Nasby, at $24,477; Robinwood Ave., with kreodone wood block, to Russell & Jennison, at $9,525, and Prescott St., with asphalt, to the Barber Asphalt Paving Co. of Cleveland, at $11,678.

Hollidaysburg, Pa.—Bids will be received Feb. 15 by the Boro. Highway Com. for curbing and paving Allegheny St. and all intersecting streets or alleys. Address Robt. W. Smith, Secy. of Council.

York, Pa.—The Common Council is stated to have passed a bill providing for the repaving with sheet asphalt on a portion of Market St.

The Common Branch of Council is stated to have passed an ordinance providing for the paving of W. Market St.

Ebensburg, Pa.—The lowest bid opened on Feb. 1 by the State Highway Dept. at Harrisburg, for constructing 5,645 ft. road from Summerhill to South Fork, in Croyle Township in Cambria County, has been submitted by T. J. Morgan and C. A. Pringle, of Summerhill, for $9,275.

Carlisle, Pa.—Bids will be received Feb. 24 by the State Highway Dept. of Pa., at Harrisburg, for constructing 3,300 ft. road in Hampden Township.

Cookeville, Tenn.—See "Power Plants, Gas and Electricity."

Fond du Lac, Wis.—R. A. Bartlett, City Clk., writes that it is proposed to pave Division Sheboygan and 2d Sts. with bitulithic or asphalt, at a probable cost of $40,000.

Toronto, Ont.—City Engr. Rust is stated to have recommended the paving of the following streets: Asphalt on Kensington Ave., brick on Argyle St., cedar block on Vermont Ave., vitrified block on Princess St., brick on Mechanic's Ave., grading and filling on Leuty Ave. and a sewer on Grace St.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Goodwater, Ala.—Arthur Salmon, of Dadeville, is stated to have secured a franchise for an electric light plant in Goodwater.

Cleveland, O.—The following are the bids opened by the Bd. of Pub. Service Feb. 1 for paving Union and Kinsman Sts.; (*a*) Baldwin Bros. & Graham, (*b*) Standard Paving Co., (*c*) Cleveland Trinidad Paving Co., (*d*) Northern Ohio Paving & Constr. Co. (*e*) Rohl Bros.:

Woodland Hills Ave., from Kinsman St. to Union St.

	a.	*b.*	*c.*	*d.*	*e.*
9,800 cu. yd. excavation or embankment	$0.35	$0.40	$0.40	$0.50	$0.40
Laying pavement:					
20 sq. ft. Medina	.30	.28	.26	.20	.25
400 " stone (relaid)	.10	.10	.08	.08	.10
20 " dressed block Medina	.30	.30	.35	.20	.30
400 " dressed block Medina (relaid)	.10	.10	.10	.08	.10
144,000 " concrete foundation	.07	.07	.07	.07	.07
144,000 " brick pavement	.14¾	.149	.15½	.14⅞	.15
800 " brick pavement (relaid)	.07	.07	.10	.05	.10
Setting, etc., curb:					
6,220 lin. ft. 5-in. Medina	.65	.70	.70	.67	.65
40 " 5-in. Berea or Amherst	.35	.35	.35	.35	.36
200 " curb stone (reset)	.10	.10	.10	.10	.10
20 sq. ft. Medina crosswalk	.30	.30	.40	.20	.40
100 lin. ft. crosswalk (relaid)	.10	.08	.10	.08	.10
24 catch basins	39.00	40.00	35.00	40.00	40.00
300 lin. ft. 12-in. catch basin pipe	.80	.75	.95	1.00	.80
3,000 sq. ft. 3-in. new flag	.15	.15	.16	.16	.16
3,000 " flag (relaid)	.03	.02	.04	.03	.03
1,000 lin. ft. French drains, complete	.27	.35	.30	.30	.30
Totals	$41,080	$42,151	$43,063	$43,004	$42,114

Woodland Hills Ave., from Union St. to Meech St.

	a.	*c.*	*d.*	*e.*
5,300 cu. yd. excavation or embankment	$0.35	$0.40	$0.50	$0.40
Laying and relaying pavement:				
40 sq. ft. common Medina	.30	.26	.20	.30
400 " common stone (relaid)	.10	.08	.08	.10
137,300 " concrete foundation	.07	.07	.07	.07
137,300 " brick pavement	.14¾	.15½	.14⅞	.15
800 " brick pavement (relaid)	.10	.10	.05	.10
Setting, etc., curb:				
8,400 lin. ft. 5-in. Medina	.65	.70	.67	.65
20 " 5-in. Berea or Amherst	.35	.35	.35	.36
200 " curb stone (reset)	.10	.10	.10	.10
40 sq. ft. Medina crosswalk	.30	.41	.20	.40
200 lin. ft. crosswalk (relaid)	.10	.10	.08	.10
43 new catch basins, each	39.00	35.00	40.00	40.00
1,200 lin. ft. 12-in. catch basin pipe	.80	.95	1.00	.80
4,000 sq. ft. 3-in. flag, (new) furnished and laid	.15	.16	.16	.16
2,000 " flag (relaid)	.03	.04	.03	.03
20 lin. ft. old 12-in. c. b. pipe. relaid	.45	.40	.40	.40
1,400 " French drains	.27	.30	.30	.30
1,500 " 15-in. sewer pipe	1.15	.65	1.25	1.35
Totals	$42,808	$43,951	$44,446	$43,930

Cincinnati, O.—The following are the bids opened on Feb. 2 by the Board of Public Service, for paving Beekman St. with granite block; (*a*) F. Kirchner, (*b*) N. Ruebel, (*c*) Keeling & Ridge Co., (*d*) W. Heffron Constr. Co., (*e*) J. W. Ross & Son, (*f*) L. Drach Constr. Co.:

	a.	*b.*	*c.*	*d.*	*e.*	*f.*
400 cu. yd. concrete	$4.00	$3.00	$4.00	$2.50	$3.98	$4.00
135 lin. ft. granite crossings	1.20	1.00	1.25	1.00	1.24	1.25
1,178 " 5-in. granite curb	1.30	1.10	1.30	1.30	1.29	1.30
80 " circular curb	2.00	2.00	2.00	2.00	2.10	2.00
30 " curb redressed and reset	.20	.20	.25	.10	.20	.20
46,500 cu. yd. grading	.43	.41	.45	.50	.50	.425
2,336 sq. yd. granite paving	3.20	2.70	3.00	3.30	3.25	3.30
2,336 " subgrade (rolling)	.05	.05	.05	.05	.05	.05
100 lin. ft. 24-in. drain pipe	2.50	1.50	2.50	2.00	1.95	2.50
100 " 18-in. drain pipe	1.70	1.25	1.50	1.70	1.65	1.75
15 cu. yd. rubble masonry	6.00	3.50	5.00	4.50	5.00	5.00
10 " brick masonry	12.00	8.00	10.00	10.00	11.50	12.00
40 sq. yd. repaving bowlders	.50	.40	.50	.20	.68	.70
30 " repaving granite blocks	1.00	1.00	.50	.40	1.05	1.10
4 pieces Palmer inlets complete	40.00	40.00	40.00	40.00	40.00	40.00
Totals	$31,886	$28,899	$32,287	$34,622	$35,180	$31,895

Vanwert, O.—Bids will be received Feb. 21 by the Trus. of Harrison Township at the office of Baiyeat & Conn, 107½ E. Main St., for $35,000 Harrison Road improvement bonds. Fred Kreischer, Township Clk.

Delaware, O.—Local press reports state that bids will be received Feb. 18 by the Co. Comrs. for $19,000 Eden and Leonardsburg Road improvement bonds.

Elyria, O.—Bids will be received Feb. 27 by the Bd. Pub. Service for furnishing material and constructing either a brick, asphalt, block asphalt, natural rock asphalt, macadam or bituminous macadam pavement on Washington St. Scott Hinman, Clk.

Altoona, Pa.—Some brick paving will probably be soon authorized by City Council. Harvey Linton, City Engr.

**England, Ark.*—The Martin-Reynolds Electric Co., of Little Rock, is stated to have secured the contract to install an electric light plant at England for J. B. Gray, for about $5,000.

San Jose, Cal.—The National Park Electric Power Co., of San Jose, is reported incorporated with a capital of $250,000, by J. J. Inman, M. E. Page, W. H. Baugh and others, all of San Jose.

Santa Barbara, Cal.—The Merchants' Mutual Light & Power Co. is reported incorporated, with a capital of $25,000, by John T. Johnston, C. H. Frink and J. H. Burson.

Fresno, Cal.—The San Joaquin Power Co. is reported to have decided to begin at once the construction of another power plant near the Crane Valley reservoir, with a capacity of 3,500 h.p. Wm. G. Kerckhoff, Pres., Los Angeles.

**Items marked thus give the names of parties awarded contracts.*

San Francisco, Cal.—The California Gas & Electric Corporation (E. J. De Sable, Jr., San Francisco) is stated to have purchased property across the line in San Mateo County on the bay shore near the Seven-Mile House. It is the intention of the company to put up a plant for supplying electric power to the United Railroads of San Francisco and to other parties. The engines for the proposed plant are reported to have been ordered.

Articles of incorporation of the San Mateo Power Co. are reported to have been filed. The purpose is stated to be to manufacture gas and electricity for heat, light and power; capital, $1,000.000. Directors: Walter J. McLean, Henry Bostwick, Leo H. Susman and others.

Los Angeles, Cal.—Local press reports state that an independent electric light and power company is about to be formed here by the Broadway Improvement Assoc. F. W. Blanchard, Maj. J. H. Norton, S. M. Schneider and others are reported interested.

It is stated that bids will be received Feb. 27 by the Bd. Co. Supervs. for furnishing and installing electric motors and making certain changes in the ventilating and heating machinery at new County Hospital on Mission Road. C. G. Keyes, Clk.

Denver, Colo.—The Denver Gas & Electric Co. is reported to have decided to construct a new building at a cost of $100,000, and improve and extend its gas mains at a cost of $200,000.

Trinidad, Colo.—The City Council is stated to have granted a 25-yr. franchise to E. Bruddenbrock to use the streets of the city for pipes for a hot water heating plant, which will supply business houses and residences with heat.

Sterling, Conn.—The Sterling Mfg. Co. is reported incorporated, with a capital of $50,000, by L. B. Penfield, F. W. Baker and M. J. Hogan, of Hartford.

Washington, D. C.—Bids will be received by Henry B. F. Macfarland, Comr. D. C., on March 20 for supplying an electric generating plant for the sewerage pumping plant, as advertised in The Engineering Record.

*Albert & J. M. Anderson, of Boston, Mass., have secured the contract for a 29-panel switchboard for the Washington Navy Yard (bids opened Jan. 23) for $13,530.

Bids will be received Feb. 21 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Annapolis, Md.; Washington, D. C., and Norfolk, Va., a quantity of arc lamps, electrical supplies, brick, broken stone, red brick, cable, battery cells, electric equipments for ammunition hoists, brass wire, copper rivets, iron pipe, pipe fittings, magnet wire, cable, incandescent lamps, mica, electric blowers, electrical supplies, Lumberton and Albany sand, gravel, lime, pig iron, iron shapes, sheet steel, iron pipe, pipe fittings, gate valves, Portland cement, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Savannah, Ga.—Bids will be received March 3 by Jas. Knox Taylor, Superv. Archt. Treas. Dept., Washington, D. C., for installing conduit and electric wiring system in U. S. Marine Hospital here.

Covington, Ga.—W. G. Flake, of Conyers, Pres. Panola Light & Power Co., writes that this company has in contemplation the extension of its lines to Covington, at a cost of about $15,000 to $20,000.

Joliet, Ill.—It is reported that the Joliet Gas Light Co. is preparing to enlarge its plant. The company intends to manufacture, produce and distribute light, heat and power in the counties of Kane and DuPage and in other counties in Illinois. Wm. W. Tracey, Pres.; Fred Bennitt, Secy.

Shirley, Ind.—B. T. Martindale, Secy. Commercial Club, writes that bids will be received about May 1 for the construction of water works and an electric light plant; probable cost from $15,000 to $25,000. All communications should be addressed to him.

Keokuk, Ia.—The U. S. Senate has passed a bill authorizing the Keokuk & Hamilton Water Power Co. to construct a dam across Mississippi River from Keokuk to Hamilton, Ill.

Waterloo, Ia.—The Peterson Heat, Light & Water Co., of Des Moines, is about to petition Council for a franchise to install a system in Waterloo. Oscar F. Peterson, of Des Moines, Pres.

Ames, Ia.—Proudfoot & Bird, of Des Moines, are reported to be preparing plans for a central heat, lighting and power plant, to be constructed at Ames for the Agricultural College, to cost about $75,000.

Oelwein, Ia.—M. E. Springer is reported to have secured a franchise to establish a gas plant.

Lacrosse, Kan.—The question of issuing $25,000 water and light bonds is reported under consideration.

Coffeyville, Kan.—W. K. Palmer, M. E., 718 Dwight Bldg., Kansas City, Mo., writes that new bids were to have been received and opened on Feb. 8 for the equipment of the proposed municipal electric light plant. The figures which were received for this work on Jan. 18 were reported in the issue of The Engineering Record, Feb. 4.

Plaquemine, La.—A charter has been granted to the Plaquemine Electric Light & Power Co., with a capital of $30,000, and with J. H. Savage, M. Dick and V. M. Barber as directors, to construct a system of electric lights for Plaquemine.

Baltimore, Md.—Bids will be received Feb. 15 by the Bd. of Awards for furnishing Bayview Asylum with electrical equipment and apparatus, consisting of one 100-kw., d. c. generator, direct connected to one 150-h.p.; simple automatic cut-off engine, one 35-kw. d. c. engine type generator, one 35-, one 10- and one 5-h.p. d. c. motors, one 75-kw. d. c. generator direct connected to one 125-h.p., simple automatic cut-off engine and substitution of two 3-wire units. E. Clay Timanus, Pres.

Sheffield, Mass.—The Sheffield Lighting & Power Co. is reported incorporated by W. Taylor Day and Geo. de P. Fox, both of Great Barrington, to furnish light and power in Sheffield.

Springfield, Mass.—The Springfield Gas Light Co. is reported to have petitioned the State Gas & Electric Light Comrs. for permission to increase its capital from $550,000 to $850,000, the money to be used for improvements, to include the improvement of the engine and purifier houses, new engine, condensers, tar extractors and purifiers, a coke-handling plant, new retorthouse, water-gas house and various new water-gas and other machinery. Some of the improvements named are now in progress.

Dowagiac, Mich.—D. E. Connine, Supt. Electric Light Plant, writes that the plant will probably be remodeled at a cost of $1,400.

Hastings, Mich.—A gas franchise is stated to have been granted to the Hastings Gas Co., composed of John Ott and Seymour Hill, of Albion, and F. W. Freese, of Ft. Wayne, Ind. They agree to lay at least 5 miles of mains, install a plant and have everything in operation by Oct. 1.

Royalton, Minn.—Bonds to the amount of $10,000 are reported sold, to be used for the construction of an electric light plant.

Hibbing, Minn.—The Hibbing Water, Light & Power Co. has been incorporated by D. D. Crowley, H. A. Liedel and John W. Day, to establish a water, light and power plant; capital, $50,000.

Higbee, Mo.—W. K. Palmer, 718 Dwight Bldg., Kansas City, has been authorized to prepare plans and specifications and superintend the construction of an electric light plant for the Higbee Electric Light, Heat & Power Co.

Kearny, N. J.—The Town Council has selected Runyon & Cary, of Newark, to prepare plans for a municipal electric light plant.

Highlands, N. J.—G. W. Hardy, Boro. Clk., writes that it is proposed to construct water works and an electric light plant, at a cost of $25,000. No engineer has been selected and the question has not yet been voted upon. P. N. Cornwell, Mayor.

Atlantic City, N. J.—The following are the three lowest bids opened on Feb. 3 by the Superv. Archt. Treas. Dept., Washington, D. C., for the electric lighting and conduits for call bell, telephone and clock wiring, etc., U. S. Post office at Atlantic City: W. W. Hill, Baltimore, Md., $2,191; McCoy Eng. Co., Baltimore, Md., $1,677, and H. Eckstein, Philadelphia, Pa., $1,975.

New York, N. Y.—Bids will be received until Feb. 21 by John F. Ahearn, Pres. Manhattan Boro., for electric wiring system in the Criminal Courts Bldg.

Albany, N. Y.—The State River Improv. Comn. is reported to have under consideration plans for harnessing Sacandaga, Racquette and Black Rivers in the Adirondacks for electrical purposes. H. A. Van Alstyne, State Engr., is on the commission.

New York City, N. Y.—Bids will be received Feb. 20, by C. B. J. Snyder, Supt. School Bldgs., for installing electric equipment in DeWitt Clinton High School and School No. 83, Boro. Manhattan.

The Bd. of Aldermen has passed a resolution to issue corporate stock to the amount of $25,000 for expenses in connection with the construction of a municipal electric light plant.

Freeport, L. I., N. Y.—Sidney H. Swezey, representing the Freeport Gas Co., is stated to have petitioned the Village Trus. for a franchise.

Watkins, N. Y.—The electric light plant of the Watkins Consolidated Gas & Electric Light Co. is reported to have been destroyed by fire on Feb. 3.

**Rochester, N. Y.*—Fish & Horton Co., of Rochester, has secured the contract for wiring several buildings at the Rochester State Hospital (bids opened Jan. 4), and Barr & Crellman, of Rochester, secured the contract for four 150-h.p. boilers for the hospital.

Saranac Lake, N. Y.—The Saranac Lake Light, Heat & Power Co. is reported to have transferred its interests to the Paul Smith Hotel Co. for $100,000. The plant is to be made part of a much larger system, and the Franklin and Union Falls water power systems further developed.

Buffalo, N. Y.—The following are reported to be the bids opened on Jan. 31 by the Bd. of Superv. for work in connection with the 65th Regt.:

Electrical equipment—F. P. Little & Co., $105,600; Robertson Electrical Co., $102,000; T. C. Stearns & Co., $97,929, and McCarthy Bros. & Ford, $89,950.

Air supply ducts and flues—Barnd & Geiger, $16,050; Timothy McAvoy & Sons, $15,600; Philip Christman & Sons, $14,655, and Machwirth Bros. & Co., $14,330.

Laying gas pipes—Henry H. Warren, $5,740; Timothy McAvoy & Sons, $5,200, and Barnd & Geiger, $5,395.

Clinton, N. Y.—The Franklin Springs Electric Light Co. has been incorporated with a capital of $5,000 to furnish electricity in Clinton, Kirkland, New Hartford and Marshall. Directors: Fred. DeW. Smyth and Delos DeW. Smyth, of Utica, and Edw. B. Stanley, of Clinton.

Kirkland, N. Y.—The College Hill Electric Light Co., of Kirkland, has been incorporated, with a capital of $5,000. Directors: C. B. Rogers, Utica, and Jos. Rudd and S. J. Saunders, of Clinton.

Rome, N. Y.—N. H. Jones, of the Rome Electrical Co., recently reported incorporated, writes that this company has been formed for the manufacture of insulated wire.

Graham, N. C.—Plans are being prepared by H. A. Pressey, 1416 F. St., N. W., Washington, D. C., for water works, an electric light plant and ice plant for Graham. Bids will probably be called for about Mar. 1.

**Oxford, N. C.*—Contracts for constructing water works, electric lighting and ice plants (bids opened Jan. 25) are stated to have been awarded as follows (Henry A. Pressey, Engr., 1416 F. St., N. W., Washington, D. C.): To Goulds Mfg. Co., Seneca Falls, N. Y., one 800-gal. triplex pump; Reeves Engine Co., Trenton, N. J., 90-h.p. vert. noncondensing engine; Cole Boiler Co., Newnan, Ga., two 150-h.p. tubular boilers; Westinghouse Elec. & Mfg. Co., Pittsburg, Pa., elec. power station equipment; Chesapeake Constr. Co., Norfolk, Va., poles, lines, arc lights, etc., and incandescent light secondary circuits; York Mfg. Co., York, Pa., 15-ton ice plant; Chicago Bridge & Iron Wks., Chicago, Ill., 100,000-gal. water tower and Glamorgan Pipe & Fdry. Co., Lynchburg, Va., cast iron pipe, specials and hydrants and valves.

Andrews, N. C.—The Andrews Light & Power Co., of Andrews, has been incorporated, with a capital of $100,000, to construct, equip and maintain water works, electric light and power plants, telephone plants, etc. Incorporators: J. Q. Barker, E. G. Henneman and others of Andrews.

Cleveland, O.—Bids will be received Feb. 17, by the Bd. Pub. Service for supplying said city with about 3,000 burners, for incandescent gas street lamps and about 10,000 parts of burners exclusive of gas cock; about 5,000 ventilators for street gas lamps, 20,000 Mica chimneys, 6 piece, 6-in. for incandescent vapor lighting; 125,000 glass chimneys 6-in. straight Zena, Thermo or Gisun chilled-proof glass without air holes, for incandescent gas lighting 20,000 16-in., and 3,000 14-in. glass boulevard globes; 10,000 14-in glass boulevard domes; 2,000 13-in. glass boulevard domes for incandescent gas lighting; 2,500 street gas lamp frames; 5,000 double end bolts for street gas lamp frames; 150,000 single weave cap mantles for incandescent street gas lighting; and 2,000 gasoline burners for incandescent street lighting. A. R. Callow, Secy.

Cincinnati, O.—Capt. McGuire is reported to have submitted to the Bd. of Pub. Service an estimate recommending an expenditure of $40,000 for an electric lighting plant at the new workhouse, and for new plumbing and heating apparatus at the refuge.

Lawton, Okla. Ter.—Two franchises for piping of natural and artificial gas to the city are stated to have been granted by City Council, one to the Deming Investment Co. and the other to the Baertich-Gibler Co.

**Anadarko, Okla. Ter.*—The City Council is reported to have awarded the contract for a lighting plant to the Union Light & Power Co. of El Reno, for $10,455.

Stroud, Okla. Ter.—A charter has been issued to the Stroud Light & Power Co. of Stroud, with a capital of $15,000. Stockholders: A. H. Sherwood, Lee Patrick and others, all of Stroud.

Cookeville, Tenn.—Bonds to the amount of $25,000 have been sold to be used for the construction of water works, an electric light plant and street improvements.

Texarkana, Tex.—The Street Ry. Co., through its superintendent, Col. E. J. Spencer, is reported to have announced that it will build an electric light plant and power house in the immediate future.

Seattle, Wash.—City Comptroller Riplinger is about to ask for bids for $250,000 bonds to be used for extending the municipal electric light plant to the residence districts of the city.

Mexico City, Mex.—The plant of the Mexican Electric Works is reported to have been seriously damaged by fire on Feb. 4; loss reported to be about $1,000,000.

Niagara Falls, Ont.—It is stated that bids are wanted Feb. 17 for erecting a cut stone or granite power house, adjacent to Queen Victoria Park, for the Electrical Development Co. of Ont. E. J. Lennox, Archt., Toronto.

Montreal, Que.—Boiler Inspector Champagne is reported to have submitted to City Council a report on the establishment of a municipal gas plant; he estimates that it will cost $2,800,000 for laying the gas mains, and $2,200,000 for establishing the plant, with an average cost price of manufacturing the gas of from 15 to 26 cts.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—The stockholders of the Douglas Sts Ry. Co. are reported to have decided to install an electric street railway, covering all the principal thoroughfares.

Little Rock, Ark.—The preliminary survey of the North Arkansas Electric Ry. & Power Co. is now completed from Mt. Hersey to Jasper, and the corps of surveyors will continue the work to Ft. Smith.

The Van Buren Electric Ry. & Bridge Co. has secured a franchise to erect a bridge across the river at this point, and to build and operate an electric railway in Van Buren.

Sonoma, Cal.—J. B. Small, City Clk., writ that S. S. Chocker and O. T. Weber, of S noma, have secured the franchise for electric railway (bids opened Feb. 1).

Stockton, Cal.—The Stockton Electric Co. (Frank W. Webster, Gen. Mgr.) is ported to have in contemplation the ext sion of its line about 4,000 ft., and the newing of its present system (6 miles lon converting it into a standard gauge.

Los Angeles, Cal.—W. F. and L. M. H are reported to be at the head of a syndic which plans to install a heavy mileage electric railways in the near future. Th hope to connect the towns of the valley w electric roads that may ultimately be tended over the mountains into the Jul fruit district and on to San Diego.

Oceanside, Cal.—John McCafferty, of Pa dena, a well-known man and mining pro ter, has been at Oceanside, recently, look into the project of an electric railway fr San Bernardino to Oceanside.

National City, Cal.—The citizens of tional City propose to construct an elec railway connecting the town with San Die A committee comprising Dr. E. M. Ely, Pc master S. S. Johnson, J. A. Rice and W. Hill, has the matter of route, franchise grading in hand.

San Jose, Cal.—The San Jose & Los Ga Interurban Ry. Co. has petitioned for a fr chise for a single-track line along San F nando St. and a single-track loop around 13th, San Carlos and Market Sts. Bids for s franchise will be received on Feb. 27. Anot franchise has been asked by the Santa Cl Interurban Ry. Co.; the owners of the fr chise recently granted to J. F. Parkinson, Palo Alto, for a line on four streets in northern part of the city. The route scribed in the application is for a dou track road along Julian, 10th, San Carlos a Market Sts. to the Southern Pacific dep The San Jose & Los Gatos Interurban R. was granted a franchise for a single-tr line on Park Ave., which completes the lo on the Campbell Short Line from Los Gat

Delta, Colo.—The County Com. h granted a franchise for an electric railw in Delta County to W. B. Stockham and L. Pike, representing Eastern people. T road will be about 100 miles in length, a will consist of one line from Delta to anthracite coal fields recently discovered Smith's Fork and another line from Delta Eckert, Cedaredge and the Grand Mesa La summer resort.

Washington, D. C.—Improvements costi about $200,000 are to be made by the Wa ington, Alexander & Mount Vernon Elect Ry. (W. T. McLean, Ch. Engr.). The line to be double tracked from Alexander to southern shore of the Potomac River.

Peoria, Ill.—Important improvements to be made by the Peoria & Pekin Termi Ry. Co. The line from Peoria to Hollis to be double-tracked, and will probably double-tracked into Pekin. It will also crease its yard facilities in Peoria and Pe and along the line.

Paris, Ill.—The Paris Traction Co. h been organized to construct several elect lines radiating from this city. One will in a western direction to Charleston, anot to Champaign, another to Ridge Farm, Vermillion County, and a fourth in a sou eastern direction to the Indiana State li The incorporators and first board of direct are: Andrew J. Hunter and F. L. Kidder, Paris, Ill.; John J. Cummings, of Chica Charles P. Hitch and Hugar L. Hodge, Paris, Ill.

Peru, Ind.—The Indiana Central Tracti Co., recently incorporated, has decided build a line from Peru to Hammond, inste of from Peru to South Bend via Plymou The newly projected route will touch Mexi Macy, North and South Mud Lakes, Fult Kewana, Lake Maxnikuckee, Bass Lake a Knox. Jerome Herff is one of the princi promoters.

Anderson, Ind.—Frank Houghman is ported to have announced that the line the proposed Toledo, Celina & Indianapo Traction line will be surveyed early in spring, and will include both Perkinsville a Noblesville.

Huntington, Ind.—The Ft. Wayne & W bash Valley Traction Co. (M. J. Kehoe, Engr., Ft. Wayne) has decided to enlarge power station at Huntington. A large pow plant is said to be contemplated for this later on.

Huntington Township is reported to ha voted a $25,000 subsidy to the Huntingt Columbus City & Northwestern Traction C which proposes to build to Goshen.

Warren, Ind.—The City Council h granted a franchise through the city to t Marion & Wabash Traction Co. The gra provides that $10,000 worth of work must completed on the line by July 1, and that line must be within 7 miles of Warren that time. The Kokomo, Marion & Warr and the Interstate, which desire to bu from Marion to points in Ohio by way Bluffton, also are applicants for franchises.

Richmond, Ind.—The Comrs. of Wayne have granted a franchise to the Indianapol New Castle & Toledo Traction Co. for t building of its line through the county. city franchise will be applied for in a f days. D. M. Parry, of Indianapolis, is ported interested in the road.

Logansport, Ind.—The Standard Oil Co., is stated, is asking for a right of w through Flora, Binghurst, Reekfield, Idavi and Monon, for the purpose of building electric railway. It is said to be part of scheme to build a traction line from Chica to Indianapolis.

**Items marked thus give the names of parties awarded contracts.*

dianapolis, Ind.—The Indianapolis, New & Toledo Electric Ry. Co. has applied e Bd. of Pub. Wks. for an independent nce to this city.

etersburg, Ind.—The Vincennes & Jas- fraction Co. has completed a survey of ne. The contract for the construction of ower house in this city, it is reported, been let to the Cincinnati Constr. Co., ston Bldg., Cincinnati, O., for $72,000.

ansville, Ind.—It is stated that bids will ceived Feb. 15 by the Evansville Subur- & Newburg Ry. Co. for erecting a pressed power house in one of the suburbs.

innell, Ia.—The Grinnell Electric Interur- Ry. Co. has been incorporated, with a tal stock of $10,000. The first survey be run from Grinnell to Tama and pos- to Belle Plaine, Ia. It proposes con- cting a line from Grinnell to Independ- , via Vinton, Ia., and also the construc- of other lines with Grinnell as the cen- station.

ioux City, Ia.—The Sioux City Traction Jos. S. Lawrence, Gen. Mgr., contemplate following improvements for the year 1905, work will start upon them as soon as weather permits: The widening of tracks Pierre, 4th and Pear Sts. to the standard ge; new heating and lighting plants and es of new mains.

alena, Kan.—The right of way has been chased and the profiles made for an elec- railway from Galena, Kan., through Lo- l to Baxter Springs. This road will be 10 es in length, and is being built by the ing River Power Co., power to be gener- d from Spring River at Lowell.

aducah, Ky.—Jefferson Read and J. J. eunditch, promoters of the proposed inter- an railway from Paducah to Cairo, Ill., ich is to be 34 miles in length, have se- ed the entire right of way, and the com- ny hopes to get work started early the ning spring. A tract of land has been se- ed near this city for a park, and the mpany proposes to build a summer hotel ere.

Rockville, Md.—The Mayor and Council of ckville have agreed on an ordinance under hich the Washington & Rockville Electric y. Co. will be allowed to extend its tracks to the town.

**Baltimore, Md.*—The contract for the ection of the new power sub-station of the nited Rys. & Electric Co., to be erected on astern Ave., is reported to have been warded on Feb. 2 to the Steel Concrete onstr. Co. The building will be 30x90 ft., d will be entirely of concrete.

Westfield, Mass.—The Hampden Contr. Co., is stated, with a capital of $25,000, has en organized to build the new line of the estern Massachusetts St. Ry. from Westfield Lee.

**Boston, Mass.*—The contract for furnish- g and delivering about 40 tons of steel tie ds and about 12½ tons of c. i. washers for ection 4 of Washington St. tunnel (bids pened by the Boston Transit Comn. Feb. 2) as been awarded to H. P. Converse & Co., of oston, Mass., for $2,549.

Boston, Mass.—The State Bd. of R. R. Comrs. has issued a certificate approving the ocations of the Plymouth County St. Ry Co. n the towns of Rockland, Hanover, Marsh- ield, Duxbury and Kingston, all in the south- eastern part of the State.

Troy, N. Y.—The Forest Park Ry. Co., which was organized about a year ago, in- ends to construct line to the north end of roy and to Rensselaer. Jacob C. Jacobs, Pres.; N. R. Holmes, Secretary and Attorney.

Rome, N. Y.—The question of granting a franchise in Rome to De Witt C. Hadcock, of Oneida, for the proposed electric railway from Rome to Oneida, is under consideration. Con- sents for the construction of the road are practically all secured for the entire line.

Canajoharie, N. Y.—Interest is being taken by business men in the proposed electric rail- way from Canajoharie to Sharon Springs, N. Y., a distance of about 40 miles. L. H. Jackson, of Sharon Springs, is reported in- terested. Probable total cost, $1,000,000.

New York, N. Y.—The Bd. of Aldermen on Feb. 7 passed a resolution granting a fran- chise to the New York & New Jersey Tunnel Co. under 6th Ave.

Newburg, N. Y.—The Intervale Traction Co. proposes building an electric railway be- tween Newburg and Goshen. W. Johnston McKay, of Newburg, Secy.

Watertown, N. Y.—The Black River Trac- tion Co. is contemplating the building of a belt line to begin at the intersection of State and William Sts. and traverse William, Wins- low, Paddock, Holcomb, Massey and Arsenal Sts. to Public Sq.

Wilmington, N. C.—The Consolidated Rys. Light & Power Co. has decided to have in- stalled another steam turbine and additional boiler capacity.

Coshocton, O.—The Zanesville, Cambridge & Northern Traction Co. has been incorpo- rated by S. A. Weller, E. C. Rinner, Frank McCormac and others, with a capital of $10,000, to build an electric railway from Zanesville to Cambridge and Coshocton.

Fremont, O.—The Lake Erie, Bowling Green & Napoleon Ry. Co. has applied for a franchise to build into Woodville. The com- pany is building an extension from Pember- ville to Woodville.

McKeesport, Pa.—The Select Council has passed on third reading a bill giving a fran- chise to the Pittsburg & Westmoreland St. Ry.

Allegheny, Pa.—Under the names of two street railway companies—the Marshall Ave. St. Railway Co. and the Watson St. Ry. Co.—ordinances have been introduced in Allegheny Council that would give permission to the two companies to cover every street in Alle- gheny not already covered by other railways. The engineering firm of Lippincott & McNeil are said to be interested.

Texarkana, Tex.—See "Power Plants, Gas and Electricity."

Dallas, Tex.—The Dallas Consolidated Elec- tric St. Ry. Co. has presented a petition to the City Council for permission to construct double tracks on certain streets, and the pe- tition has been referred to the Pub. Improv. Com. M. M. Phinney, Gen. Mgr.

Chilliwack, B. C.—The Chilliwack Light & Power Co., of which J. B. Morgan is mana- ger, is planning to commence work early in the spring on its power plant and electric railway, the latter to extend from Chilliwack to New Westminster. The power plant and transmission line is estimated to cost $125,000.

Vancouver, B. C.—The papers have been signed for the transfer of the Vancouver & Lulu Island Ry. to the British Columbia Elec- tric Ry. Co. (J. Buntzen, Gen. Mgr.). Work will be commenced, it is reported, immediately to convert the road into an electric system. A sub-station will be built at Eburne and elec- tric locomotives will be used in the handling of freight.

Winnipeg, Man.—The Legislature has passed a bill incorporating the Winnipeg & St. Andrews Electric Ry. Co.

**Ottawa, Ont.*—The Ottawa River Electric Ry. Co., it is stated, has awarded a contract to F. McGrath, of Easton, Pa., for the con- struction of an electric railway between Mon- treal and Ottawa.

Brantford, Ont.—The Governor-General's proclamation has been issued bringing into effect the charter granted last session incor- porating the Brantford & Hamilton Electric Ry., with power to construct an electric rail- way from Brantford through the townships of East Brantford, Ancaster and Barton, touching the village of Ancaster, to Hamilton. The company must expend $45,000 in the next 2 years and finish the road and put it in operation within the next 5 years.

Hamilton, Ont.—The Hamilton, Grimsby & Beamsville Electric Ry. Co. (Geo. E. Waller, Secy. & Mgr.) is having plans and surveys made to extend its line 4 miles from Vine- mount so as to form a connection with the Niagara, St. Catharines & Toronto Electric Ry., recently bought by the McKenzie-Mann syndicate.

Windsor, Ont.—The company which will build an electric railway from this city through Leamington and Kingsville to Chat- ham, will be known as the Windsor, Essex & Lake Shore Rapid Ry. Co. Its American headquarters are at 1020 Chamber of Com- merce, Detroit, Mich. Work is expected to commence this spring.

Toronto, Ont.—The York & Toronto Radial Ry. Co. has plans under way for considerably extending the radial railway system around Toronto. The extension from Long Branch to Oakville will be undertaken at an early date, and the Metropolitan extension to Lake Sim- coe will be commenced as soon as spring opens.

St. Jerome, Que.—It is reported a syndi- cate headed by John Wm. Molson, of St. Francois Xavier St., Montreal, is applying to the Provincial Legislature for charter rights for the organization of the Electric Ry. Co. of Lac Achigan. The company propose to build two electric lines, one from St. Jerome to Lac Achigan, running through Shawbridge, and one from St. Jerome to New Glasgow, and running through the town of St. Sophie. The immediate object of the incorporators is to get the line running from Shawbridge, which is a C. P. R. station, to the lake. The dis- tance is 10 miles, and the line is stated to present few engineering difficulties, while power can be obtained from two waterfalls on the route.

RAILROADS.

Notes Arranged Alphabetically by States.

Idaho Springs, Colo.—The Denver & Inter- mountain Ry. is reported to be considering the extension of its line to Idaho Springs, a distance of about 20 miles. B. M. Smith, Supt., Denver.

Moultrie, Ga.—The Georgia Northern Ry. Co. is reported to have decided to increase its capital to $500,000, and will build an ex- tension of 35 miles southeast from a point between Moultrie and Pavo to Valdosta. J. N. Pidcock, Jr., Gen. Mgr., Moultrie.

Offerman, Ga.—Press reports state that the Atlantic & Birmingham Ry. Co. (Geo. Dole Wadley, Gen. Mgr., Waycross) will expend about $100,000 in rebuilding and widening the roadbed between Offerman and Nicholls.

Chicago, Ill.—The Chicago & State Line Ry. Co. has been incorporated, with a capital of $10,000, to construct a railroad north from a connection with the Chicago & Northwestern Ry., near Lake Bluff, to the northern boundary of Illinois. Incorporators: J. M. Whitman, Chicago; W. A. Gardner, Evanston; H. R. McCullough, of Lake Forest, Ill., and others.

Danville, Ill.—The Danville & Indiana Har- bor R. R. Co. has been incorporated, with principal office at Chicago; capital stock, $2,500. It is proposed to construct a line from Danville to the State line between In- diana and Illinois, a distance of about 15 miles. Incorporators: Bertrand Walker, Robt. J. Cary, E. T. Glennon and others, all of Chicago.

Davenport, Ia.—The Rock Island R. R. Co. (W. L. Darling, Ch. Engr., Chicago, Ill.) is reported to be planning extensive improve- ments on its line between Davenport and Kansas City, Mo., at a cost of about $1,000,- 000.

New Orleans, La.—A charter has been filed by the New Orleans Great Northern R. R. Co., which has been organized to take over the East Louisiana R. R., to construct and other- wise acquire and operate a railroad line from Slidell, La., through the parishes of St. Tam- many and Washington, and form connections with another railroad between Slidell and New Orleans, or to build and operate such another railroad; capital, $1,100,000. F. H. Goodyear, Pres.; C. J. James, Secy. A char- ter has also been filed by the company, which is to construct the new road, the Great Southern Ry., Constr. Co., with a capital of $25,000, with Victor Thrane, of the timber firm of James D. Lacey & Co., of this city, president.

Detroit, Mich.—The Michigan Central R. R. Co. is reported to be considering the construc- tion of a tunnel under Detroit River, connect- ing Detroit and Windsor. W. S. Kinnear, Ch. Engr., Detroit, Mich.

Union, S. C.—The stockholders of the Union & Glenn Springs R. R. are reported to be considering the question of issuing $1,200,000 bonds and of extending its line. Geo. M. Wright, Gen. Mgr., Union.

Memphis, Tenn.—The application for a charter for the Pensacola, Alabama & Western R. R. of Tennessee has been filed and recorded in the office of Jas. C. Jones, County Register, and forwarded to John W. Morton, Secy. of State, at Nashville. W. J. Crawford, C. H. Raine, Jas. Nathan and others are the incorporators. It is proposed to construct a railway from Memphis to a point on the southern boundary of Tenn., which divides the State from the County of DeSoto, in Miss., at which said line can make connection with a railroad to run in a southeasterly direction through the State of Mississippi and into the County of Pickens, in Alabama.

Houston, Tex.—Press reports state that the Trinity & Brazos Valley R. R. is to be ex- tended to Houston. P. A. Gorman, Gen. Supt., Cleburne, Tex.

Orange, Tex.—The Orange & Northwestern R. R. Co. is stated to have completed ar- rangements for the extension of its line from Buna north to Logansport in a line heading for Shreveport. H. L. Montandon, Ch. Engr., Orange.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Ft. Whipple, Ariz. Ter.—Maj. C. C. Wol- cutt, Constr. Q. M., it is stated, has an- nounced that $187,500 has been appropriated by the War Dept. for the construction of 17 buildings at this post.

Hot Springs, Ark.—It is reported that bids will be received until March 6 for erecting a court house and jail; probable cost, $100,000. Geo. H. Lower, Bldg. Comr.

Magnolia, Ark.—Bids will be received March 12 by R. S. Warnock, Pub. Bldg. Comr., for erecting a courthouse. Wm. S. Hull, Archt., Jackson, Miss.

Ft. Logan H. Roots, Ark.—Bids are wanted Feb. 16 for constructing a brick administra- tion building, including plumbing, hot water heating and wiring for electric lighting at this post. Maj. Robt. R. Stevens, Ch. Q. M., U. S A., San Antonio, Tex.

New London, Conn.—See "Miscellaneous."

Norwich, Conn.—The Co. Comrs. are stated to have favored plans submitted for a 3-story addition to the Court House at a cost of about $30,000.

Washington, D. C.—The following are the bids opened on Feb. 4 by Elliott Woods, Supt. U. S. Capitol Bldgs. & Grounds, for excava- tion incident to the construction of an office building for the U. S. Senate (about 52,000 cu. yds.; price given per cu. yd.): J. E. Moeds, New York, N. Y., 54½ cts.; 90 work- ing days. Abbott & Gambel Co., New York, N. Y., 47½ cts.; 90 working days. C. Mc- Dermott, New York N. Y., 35 cts.; 50 work- ing days. J. E. Connely & Co., New York, N. Y., 59 cts.; 90 working days. District Constr. Co., Washington, 48 cts.; 90 working days. Cranford Paving Co., Washington, 70 cts.; 100 working days. Brennan Constr. Co., Washington, 52 cts.; 100 working days.

Bids will be received March 3 by Mordecai T. Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, for constructing a steel and concrete floor in building No. 118 at navy yard here.

Bids will be received on March 8 by El- liott Woods, Supt. U. S. Capitol Bldg. & Grounds, for cut stone work for the exterior facades and court walls of office building for the House of Representatives, as adver- tised in The Engineering Record.

Key West Barracks, Fla.—Bids will be re- ceived by the Quartermaster on March 9 for constructing a boat house at this post, as ad- vertised in The Engineering Record.

Albany, Ga.—The City Council has de- cided to accept the proposition of Andrew Carnegie to donate $10,000 to erect a library here.

Savannah, Ga.—Bids will be received by the Superv. Archt. Treas. Dept., Washington, D. C., on March 9 for a low pressure steam heating and ventilating apparatus for the U. S. Marine Hospital at Savannah, as ad- vertised in The Engineering Record.

Ft. Screven, Ga.—Capt. Jos. T. Davidson, Q. M., U. S. A., Savannah, writes that all bids opened on Jan. 16 for the erection of a hospital at Ft. Screven, including the plumb- ing and electric wiring, have been rejected and plans will be modified. Probable cost of building reported to be $20,000.

Chicago, Ill.—Bids are wanted Feb. 13 for furnishing material and erecting a double corner 2-story and basement stone and brick fire engine house at Michigan Ave. and 14th St. F. W. Blocki, Comr. Pub. Wks.

**Vincennes, Ind.*—The Standard Constr. Co. of Chicago, Ill., has secured the contract for constructing U. S. Post Office at Vincennes (bids opened Dec. 29) for $48,670.

**Knoxville, Ia.*—F. S. Treat, of Des Moines, Secy. State Bd. of Control, writes that the contract for erecting three buildings and re- modeling one building at the Asylum for In- ebriates (bids opened Feb. 1) has been awarded to Chas. Weitz Sons, of Des Moines, for $66,367. Contracts for other portions of the work are stated to have been awarded as follows: Plumbing, to the Des Moines Plumb- ing Co. of Des Moines, for $12,000; boilers and smokestack to the Des Moines Mfg. Co. of Des Moines, for $4,200, and electric ma- chinery and equipment to Arthur Frantzen Co. of Des Moines, for $6,500.

Ft. Des Moines, Ia.—The following are the bids opened by Capt. L. Hardeman, Q. M. 11th Cavalry, Constructing Q. M., Ft. Des Moines, Jan. 19, for construction, plumbing, etc., of 1 field officers' qrs., 2 dbl. sets captains' qrs., 2 dbl. sets lieutenants' qrs., 1 dbl. set qrs. for civilian employes, 2 dbl. cavalry barracks, 2 dbl. stable guard and shop buildings, 4 cavalry stables, 1 wagon shed and an addi- tion to Q. M. storehouse, at said Post:

Construction, proper (including piling for 2 stables)—Capital City Brick & Pipe Co., Des Moines, $270,000; Congress Constr. Co., Chicago, Ill., $319,441; Chas. E. Carson, Chicago, Ill., $254,853; Goldie Bros., Chicago, Ill., $269,350; N. P. Fransen & Co., St. Paul, Minn., $163,200 (for first 8 buildings); P. M. Hennessy, St. Paul, Minn., $300,305; New- man & Hoy, St. Paul, Minn., $247,000; W. J. Zitterell, Webster City, Ia., $258,733; Jos. B. Betts, Topeka, Kan., $276,423; W. M. Allen Son & Co., Peoria, Ill., $315,950; C. E. At- kinson, Webster City, $279,954; G. W. At- kinson & Son, Colorado Springs, Colo., $269,- 130; Chas. Weitz's Sons, Des Moines, $263,- 978; J. E. Tusant, Des Moines, $258,- 232; Wm. Hamilton, Des Moines, $260,- 413; S. A. Robertson, Des Moines, $290,000.

(*a*) Plumbing; (*b*) steam heating.—Tholen Bros., Leavenworth, Kan., *a*, $25,819; *b*, $15,- 234. Symms-Powers Co., Sioux Falls, S. D., *a*, $21,304; *b*, $13,645. J. J. Hanighen, Omaha, Neb., *a*, $24,280; *b*, $13,420. The Dwyer Plumbing & Htg. Co., St. Paul, Minn., *a*, $27,502; *b*, $15,990. Des Moines Plumbing & Htg. Co., Des Moines, *a*, $23,973; *b*, $15,- 171. L. H. Kurtz Co., Des Moines, Ia., *a*, $29,413; *b*, $12,896. Allan Black Co., St. Paul, Minn., *a*, $22,379; *b*, $14,206. George A. Kees, St. Paul, Minn., *a*, $23,176; *b*, $12,- 898. W. I. Gray & Co., Minneapolis, Minn., *a*, $24,155; *b*, $14,551. Graber Bros., Law- rence, Kan., *a*, $23,313; *b*, $13,581. E. J. McDonough & Co., Chicago, Ill., *b*, $12,807; Wm. A. Pope, Chicago, Ill., *b*, $13,063; Cen- tral Htg. Co., St. Louis, Mo., *b*, $14,723, and Saxton Htg. Co., Minneapolis, Minn., *b*, $14,- 094.

Electric Wiring, Etc.—Geo. A. Kees, St. Paul, Minn., $4,027; W. I. Gray & Co., Min- neapolis, Minn., $3,770; Graber Bros., Law- rence, Kan., $3,781; McFell Electric Co., Chi- cago, Ill., $2,260; Berggren Electric Co., St. Paul, Minn., $3,975; The Straight Electric Co., Des Moines, $2,887; Tri-City Electric Co., Des Moines, $3,960; Western Electrical Co., Omaha, Neb., $4,234; E. C. Bennett & Co., Omaha, Neb., $4,440; T. H. Rattenbury, Des Moines, $3,575.

Lexington, Ky.—A stone library, 98x77 ft., it is stated, is to be erected at Massachusetts Ave. and Clark St., and is to be known as the Cary Memorial Library.

Ft. Rodman, Mass.—Bids will be received by Capt. H. C. Hodges, Jr., Q. M., U. S. A., Newport, R. I., on March 10 for constructing buildings at Ft. Rodman, New Bedford, Mass., as advertised in The Engineering Record.

**Boston, Mass.*—John Woodbury, Secy. Metropolitan Park Comn., writes that the contract for building a bath house at Nahant Beach has been awarded to the H. P. Cum- mings Co., 178 Devonshire St.; contract re- ported to be about $58,000. Architects, Stickney & Austin, 50 Bromfield St.

Gloucester, Mass.—The State Armory Comn. will erect during the present year a new armory for Co. G, 8th M. V. M., to cost, with site, $60,000. Geo. Howland, of Cam- bridge, Secy. of Comn.

Haverhill, Mass.—The plans of Andrews, Jacques & Rantoul, of Boston, have been ac- cepted for a new State Armory to be erected here.

Elbow Lake, Minn.—Bids will be received by the Co. Comrs. until March 9 for fur- nishing material and erecting a 2-story and basement stone and brick court house, prob- able cost $50,000. Copies of the plans and specifications may be obtained on a deposit of $25, $10 to be refunded on return of plans. J. S. Arneson, Co. Aud.; Bell & Det- weiler, Archts., Minneapolis.

Jackson, Miss.—It is reported that the Trus. of the Baptist Orphanage have decided to erect a new dormitory at a cost of about $15,000.

Jefferson City, Mo.—It is stated that the erection of a new Supreme Court Bldg., at a cost of about $200,000, is under considera- tion.

Nevada, Mo.—The following are the bids opened on Feb. 7 by the Superv. Archt. Treas. Dept., Washington, D. C., for the construction, complete, of the U. S. Post Office at Nevada: Walter Peterson, Omaha, Neb., $38,850; J. B. Bates, Topeka, Kan., $38,643; J. A. Daly, Nevada, $36,607; W. J. Turner Co., Chicago, Ill., $37,624; Richey Bros., Hastings, Neb., $35,432; John Low, St. Louis, $39,987; D. E. Marshal, Kansas City, $31,850; Dieter & Wetzel, Joplin, $36,452; C. S. Davis, Neosho, $37,560; Cuthbert & Sargeant, Topeka, Kan., $35,807; Latimer & Bennings, Kansas City, Mo., $33,888.

**Items marked thus give the names of parties awarded contracts.*

Laconia, N. H.—The trustees of the estate of O. W. Goss will soon ask for plans for the new reading room at the Lakeport end of the city. This will be a small building, and may not cost $10,000. Stanton Owen, Laconia, N. H., may be addressed.

Newark, N. J.—Bids will be received Feb. 15 by the Com. on Pub. Bldgs. of Common Council for furnishing material and erecting 13th Ward fire engine house No. 17, on Clinton Pl.; bids for mason, iron and carpenter work, plumbing, steam heating and electric wiring to be submitted separately. C. Frank Bertrand, Archt., 800 Broad St.; Wm. Pennington, Chmn.

Atlantic City, N. J.—The following are the three lowest bids opened on Feb. 2 by the Superv. Archt. Treas. Dept, Washington, D. C., for the hot water heating of the U. S. Post Office at Atlantic City: The William Htg. Co., New York, N. Y., $5,393; West End Htg. & Electric Co., New York, N. Y., $5,711, and S. Faith & Co., Philadelphia, Pa., $5,910.

Sandy Hook, N. J.—Bids will be received by S. I. Kimball, Gen. Supt. U. S. Life-Saving Service, Washington, D. C., on Feb. 21 for the construction of an addition to the outbuilding, etc., at the Sandy Hook Life-Saving Station, as advertised in The Engineering Record.

**Albany, N. Y.*—Contracts have been awarded by the State Comr. in Lunacy at Albany as follows (bids opened Dec. 28): To P. Delany & Co. of Newburgh, for a 185-h.p. boiler with mechanical stoker at the Middletown State Hospital, and to Edwin Burhorn of New York, for a 100-h.p. boiler at the Manhattan State Hospital at Central Islip.

New York, N. Y.—Bids will be received March 11 by Mordecai T Endicott, Ch. Bureau Yards and Docks, Navy Dept., Washington, D. C., for constructing a fireproof naval prison at navy yard here. Plans and specifications will be furnished on deposit of $25.

Plans have been filed by Alex. Stevens, Ch. Archt. of the Fire Dept., for a 3-story station house for Fire Engine Co. No. 6, now in Cedar St., to be built at No. 113 Liberty St. It will be 25x86 ft., of brick, with limestone trimmings, and cost $36,000.

Bids will be received until Feb. 21 by John F. Ahearn, Pres. Manhattan Boro., for masonry, iron work, renovating, carpentry, etc., in the 13th Dist. Municipal Court at 264 Madison St.; also on same date for furnishing material and installing a low pressure stem heating apparatus; and for plumbing, etc., in said building.

Ft. Ontario, N. Y.—Bids will be received by Capt. W. M. Coulling, Q. M., U. S. A., Oswego, on March 10 for the construction of a wagon shed and a coal shed at Ft. Ontario, as advertised in The Engineering Record.

Geneseo, N. Y.—The Co. Bd. of Superv. has referred to the Co. Bldg. Com. the matter of repairing the county jail, with power to procure plans and estimates of cost.

Warsaw, N. Y.—A Carnegie Library is to be erected here of buff brick at a cost of $13,000.

Cleveland, O.—Worcester R. Warner, of Warner & Swasey; M. F. Bramley, Pres. & Mgr. Cleveland Trinidad Paving Co.; Chas. J. Estep, first asst. solicitor, and Chas. W. Whitmarsh, of Crow & Whitmarsh, it is reported, have been appointed as the four citizens who are to act with three county commissioners as the members of the County Bldg. Comn. The Comn. will have charge of all the details, direct the plans, advertise for bids, award contracts and manage the construction. Julius C. Dorn is the official clk. of the Comn.

Dayton, O.—The Bd. of Health has recommended the construction of a quarantine hospital to cost about $25,000.

The Co. Comrs., it is stated, have entered into an agreement with the Montgomery County Agricultural Society to erect a new grandstand at the County Fair Grounds at a cost of about $24,000.

Cincinnati, O.—See "Power Plants, Gas and Electricity."

Hollidaysburg, Pa.—The Co. Comrs. have approved the plans of W. L. Plack, 1403 Filbert St., Philadelphia, for the 3-story annex to the Blair County Court House, which is to cost about $100,000.

Lebanon, Pa.—Bids will be received by the Superv. Archt. Treas. Dept., Washington, D. C., on March 27, for the construction of a U. S. Post Office at Lebanon, as advertised in The Engineering Record.

**Philadelphia, Pa.*—Henderson & Co., 1221 Arch St., has secured a permit to erect a 1-story brick library, 124x68 ft., at Lehigh Ave. and 6th St., to cost $90,000.

Pineridge, S. D.—Bids will be received Feb. 28 by F. E. Leupp, Comr. Indian Affairs, Dept. Interior, Washington, D. C., for constructing a brick office building, etc., at Pineridge Agency. For further information apply to John R. Brennan, Agent.

Lawrenceburg, Tenn.—Bids will be received March 1 by the Bldg. Com. for erecting a courthouse here. M. Richardson, Secy.

Winchester, Va.—Alex. M. Baker, Chmn. Bldg. Com. Handley Bd. of Trus., writes that plans are being prepared by Barney & Chapman, 520 Fifth Ave., New York, N. Y., for the John Handley Memorial Library; probable cost, $100,000.

Richmond, Va.—The officials of the Chesapeake & Ohio Ry. (F. B. Isaacs, Div. Engr., Richmond), it is reported, are contemplating the erection of locomotive works with a capacity of 30 engines per month, at a cost of $1,000,000. They have not decided upon the location of the shops, but are said to be considering Richmond, Va., and Huntington, W. Va.

Seattle, Wash.—It is reported that bids will soon be asked for $175,000 jail bonds.

Charleston, W. Va.—The Senate has passed the House bill appropriating $75,000 for the erection of a State Armory for the National Guard.

Wheeling, W. Va.—The following are the bids again received and opened by the Superv. Archt. Treas. Dept., Washington, D. C., for constructing the U. S. Post Office, Court House and Custom House at Wheeling; (*a*) marble; (*b*) white granite; (*c*) gray granite: John C. Robinson, Chicago, Ill., *a*, $266,743; *c*, $259,259. Broderick & Winn, St. Louis, Mo., *a*, $264,098; *b*, $279,530; *c*, $257,139. W. E. Spier, Washington, D. C., *a*, $274,000; *b*, $269,000; *c*, $259,000. Richardson & Burgess, Washington, D. C., *a*, $265,718; *b*, $259,815; *c*, $260,937. Mankin Constr. Co., Richmond, Va., *a*, $272,000; *b*, $264,288; *c*, $264,288. Standard Constr. Co., Chicago, Ill., *a*, $263,000; *b*, $261,000; *c*, $256,000. Fissel & Wagner, New York, N. Y., *a*, $284,950; *b*, $319,000; *c*, $296,000. Cramp & Co., Philadelphia, Pa., *a*, $275,680; *c*, $269,427. C. W. Gindele Co., Chicago, Ill., *a*, $312,000; *b*, $278,500.

Superior, Wis.—Bids will be received March 28 by Jas. Knox Taylor, Superv. Archt. Treas. Dept., Washington, D. C., for constructing (except elevators, heating apparatus, electric wiring and conduit) U. S. Post Office, Court House and Custom House here.

Madison, Wis.—The Capitol Improv. Comn. has submitted a report to the Legislature in which they recommend the plans prepared by Cass Gilbert, of New York City, for the new capitol, the estimated cost being $5,404,228.

Ft. D. A. Russell, Wyo.—Bids are wanted Feb. 15 for constructing a field officers' quarters, 2 double sets captains' quarters, a double set lieutenants' quarters, a bachelor officers' quarters, 2 double barracks, a wagon shed, enlargement of guardhouse and quartermaster's storehouse at this post. Capt. W. S. Scott, Q. M., U. S. A., Cheyenne.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Huntsville, Ala.—It is stated that the Lodge of Elks has purchased a site and will erect a home and theatre to cost about $35,000.

Birmingham, Ala.—Reports state that an entire block on 21st St., between Morris and West Aves., has been destroyed by fire.

Little Rock, Ark.—Dr. S. S. Stewart, it is stated, has applied for a permit to erect a 2-story brick office building and residence on 9th and Scott Sts., to cost about $20,000. C. L. Thompson, Arkansas Bldg., is the archt.

**New Haven, Conn.*—Sylvester Z. Poli, of New Haven, it is reported, has awarded the contract to erect a theatre on Church St. to John O. Loughlin, of Hartford, at about $250,000.

Washington, D. C.—The members of the Metropolitan Club on Feb. 1, it is reported, decided to erect a new clubhouse at 17th and H Sts., to replace the structure which was recently destroyed by fire. The cost is estimated at about $250,000.

Mattoon, Ill.—The I. O. O. F., it is reported, have decided to erect a building in this city to cost about $60,000. Address Secy. Bldg. Com.

Chicago, Ill.—B. H. Marshall, Cable Bldg., it is stated, is preparing plans for a clubhouse to be erected by the Chicago Automobile Club on Plymouth Pl. and Jackson Boule. Estimated cost, $150,000.

It is stated that the Chicago Portrait Co. will erect a building at Wabash Ave and Congress St., to cost $300,000.

Plans for the erection of a modern fireproof building on the North Side, to contain a home for working boys and girls, and to cost about $1,000,000, are being drawn, and as soon as the site is purchased building operations will be begun. The building is planned by the Bush Temple Christian Church, of which the Rev. Dr. George E. Hall is pastor.

Aaron E. Nusbaum will erect at 309 Clark St. a mercantile building 10 stories high, with foundations strong enough to carry 6 additional stories and to cost $250,000.

Geo. W. Stewart will erect at Winthrop and Lawrence Aves. a 3-story building according to plans by Frank V. Newell, 78 La Salle St. It will cover 43x100 ft., and cost $50,000.

The Cook County Lodge, No. 240, I. O. O. F., has acquired a site at 63d St. and Yale Ave., and will soon begin construction on a 2-story lodge hall, 50x130 ft., of brick and stone, which is to cost $35,000.

A fireproof warehouse, costing $100,000, is to be built at Cottage Grove Ave. and 52d St. for J. A. Carroll. It will be 5 stories high, 120x100 ft. A. E. Robinson, 84 La Salle St., is the archt.

Connersville, Ind.—M. R. Hasecoster, of Richmond, Ind., it is reported, has prepared plans and will receive bids for erecting a $20,000 pressed brick, 3 stories and basement, business building.

Wabash, Ind.—Fremont McLees is Secy. of Com. which will have charge of erecting an opera house for the Eagles' Assoc. of this city, to cost about $50,000.

Goshen, Ind.—It is stated that Patton & Miller, of Chicago, Ill., are preparing plans for an opera house to be erected here at a cost of $35,000. Harry M. Sanders may be able to give further information.

Indianapolis, Ind.—Rubush & Co., of Indianapolis, it is reported, are preparing specifications for the 6-story brick and stone office and business bldg., which the Indianapolis Castle Hall Assoc. intend erecting at Ohio and Hudson Sts. Fletcher Noe is Chmn. Bldg. Com.

The Labor Temple Com. of the Central Labor Union, it is reported, is contemplating the erection of a coliseum for organized labor in this city, at a cost of about $100,000.

Cedar Rapids, Ia.—It is reported that bids will be received by the Palmer Bldg. Co. until Feb. 15 for erecting an office building, 3 stories high. A. N. Palmer, Pres.

Iowa Falls, Ia.—Item appearing in the issue of Feb. 4, under Iowa City, Ia., stating that E. S. Ellsworth intended erecting a 3-story hotel at a cost of about $40,000, should have been under Iowa Falls.

Sioux City, Ia.—Abel Anderson, it is stated, has ordered plans prepared for a 2-story and basement building, which is to be erected for the Northwestern Bank at 4th and Pierce Sts at a cost of $35,000.

Davenport, Ia.—Ruymann Bros., it is stated, are contemplating the erection of a 10-story bank and office building at 2d and Harrison Sts., and have had plans prepared for the same. Probable cost, $125,000. Claus J. Ruymann may be able to give further information.

Paducah, Ky.—Friedman, Keller & Co., it is stated, have had plans prepared for a business building to be erected at N. 2d and Jefferson Sts.

Baton Rouge, La.—The St. James Masonic Lodge of Baton Rouge, No. 47, have selected the plans of L. M. Weathers, of Memphis, Tenn., for a 3-story building of pressed brick, with stone trimmings. Estimated cost, $25,000. Bids will be asked for in about 2 weeks.

New Orleans, La.—It is reported that Louis P. Rice has decided to erect a 7-story building at Magazine St. and Common, on the site of the structure which was destroyed by fire.

**Muir & Fromherz, 2125 Calliope St., it is reported, have received the contract to erect a $100,000 building for the D. H. Holmes Co., Ltd.

Bangor, Me.—Saml. Sterns will erect a 5-story office building on Exchange St. in the spring.

Baltimore, Md.—The trustees of the Sheppard and Enoch Pratt Hospital have commissioned Charles E. Cassell & Son, of Baltimore, to prepare plans for a 4-story warehouse to be erected at 210 and 212 E. Lombard St.

Gloucester, Mass.—Fire in this city on Feb. 1 is reported to have destroyed several buildings, including the Tappan Blk., which is owned by Ida and Lucy Tappan.

Boston, Mass.—Plans filed with the Bldg. Com., by Archts. Peabody & Stearns, Exchange Bldg., for an 8-story, fireproof, brick and stone storehouse for R. H. White Co., to be located at 33-39 Taylor St.; floor area, 65x97 ft. Also by the Boston Wharf Co., 274 A. St., for a 9-story brick and stone office and wool storage building, 145x73 ft., to be located on Summer St., near Melcher St., South Boston.

**Fall River, Mass.*—Beattie & Cornell, of Fall River, have secured the contract for erecting a 5-story building for the Globe Publishing Co. Architect, Jos. M. Darling, 56 N. Main St.

Lawrence, Mass.—The Essex Savings Bank contemplates remodeling its building into an office building.

St. Paul, Minn.—A permit has been granted to the Chicago, Milwaukee & St. Paul Ry. Co. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) to erect an addition to its freight houses on 2d St., S., at a cost of $24,000.

**Minneapolis, Minn.*—C. F. Haglin, 228 Lumber Exchange, it is reported, has received the contract to erect a $225,000 family hotel and apartment house 6 stories high on Hennepin Ave.

It is reported that the Moulton-Jordon Motor Car Co. (E. H. Moulton, Jr., Pres.) will erect a garage at a cost of $20,000.

Kansas City, Mo.—I. W. Munn will erect a brick store at 1001-3 McGee St., to cost about $28,000.

Omaha, Neb.—It is reported that preliminary plans for a 6-story building to be erected at 10th and Harvey Sts. by the Crane Co., gas and water supply jobbers. R. T. Crane, Pres., Chicago, Ill.

**Newark, N. J.*—V. J. Hedden & Sons, 431 Ogden St., it is reported, have received the contract to erect a 6-story addition to the Continental Hotel at a cost of about $95,000.

*The contract to erect a brick, iron and stone stable, 37x270 ft., for Wm. F. Mullin, Prop. of the Vogt Stables at High St. and Boyden Pl., it is reported, has been secured by E. M. Waldron & Co., Cabinet and S. 8th Sts. Probable cost, $45,000.

Rochester, N. Y.—Plans are about completed for a 5-story brick and steel fireproof office building, which the Buffalo, Rochester & Pittsburg R. R. Co. will erect at Main St., W. and Washington St., at a cost of about $400,000. J. M. Floesch, Ch. Engr., Rochester.

Binghamton, N. Y.—Edwin B. Searles, Gen. Secy. Y. M. C. A., writes that competitive plans will be received up to April 1 for a Y. M. C. A. building to be erected on Washington St.; cost not to exceed $100,000.

Brooklyn, N. Y.—Montrose W. Morris, 2 Hancock St., it is reported, has prep plans for a new 5-story building for the ciety for the Prevention of Cruelty to dren, which is to be erected at 107 Scher horn St.

**Fargo, N. D.*—Bowers Bros., of Farg is stated, have received the contract to the Dixon Bldg. on Broadway, to cost a $13,417. This contract does not include ing and plumbing, bids for which will b ceived later.

Steubenville, O.—W. H. Lowe, prop, of Imperial Hotel, it is reported, is having prepared for a 7-story steel and brick proof building, which is to cost about $80

Columbus, O.—Bids will be received 15 by the Bd. Pub. Service for extending larging, improving and repairing North market house. Chas. H. Frank, Secy.

Cleveland, O.—The Shoreham Bldg. Co is stated, has purchased the building at Euclid Ave., and will erect an annex to east and to the west sides of the present b ing and other improvements, at a total penditure of about $125,000.

Coshocton, O.—The Lodge of Odd Fell it is reported, has purchased a site and erect a building to cost about $25,000.

Columbus, O.—The Capital City Savin Trust Co., it is reported, intends erecti 16-story business building on Broad St granite, terra cotta and brick, and have proved plans submitted by Frank L. Pack Hayden Bldg.

Toledo, O.—It is reported that the portion of the union station which is t erected at 10th and Adam Sts. by the bash R. R. Co., will be constructed this and the wings as they are needed. Prob cost, $500,000. W. S. Newhall, Ch. Engr. Louis, Mo.

Bucyrus, O.—The Aerie of Eagles, it ported, has decided to erect a buildin cost $25,000. H. W. Valentine is reporte terested.

Cincinnati, O.—Harry Hake, Union T Bldg., is said to be preparing plans for a story building, which Jos. A. Andrews Newport, will erect at 5th and Race Sts an estimated cost of $250,000.

The Robt. F. Walter Amusement Co., reported, has leased 12 acres of land in W burn Ave. and intends erecting building a cost of $300,000.

Pittsburg, Pa.—The executors of the tate, it is reported, are preparing to c out the plans of the late Henry W. O and to erect a 14-story office building Smithfield St. and Oliver Ave., and are ing plans prepared by D. H. Burnham & The Rookery, Chicago, Ill.

An 8-story brick and steel fireproof mercial building is to be erected by E Thaw at Third Ave. and Wood St., and cost about $100,000. Plans are being pared by W. G. Wilkins, Westinghouse H. C. Frick, it is stated, is conside plans for a 21 or 22-story annex to the F Bldg. on Diamond St., to cost a $1,000,000.

**East Liberty, Pa.*—The Pennsylvania R. Co., it is stated, has awarded the cont for the superstructure of the passenger tion to be erected here, to Roydhouse, & Co., of Philadelphia.

Philadelphia, Pa.—Plans have been proved by the Bd. of Directors for the o building to be erected for the Tradesm Trust Co., at Juniper and Chestnut Sts. is to be of granite, 12 stories high.

Knoxville, Tenn.—J. W. Fox will erec brick business building on Asylum St., cost $10,000.

Nashville, Tenn.—It is reported that ford Bros. will erect a warehouse at Hi son St. and Eighth Ave., N, to cost a $30,000.

**Memphis, Tenn.*—Olson & Lesh, it is ported, has received the contract for Dillard Bldg. at $55,000, and the Coffin B at $65,000.

Houston, Tex.—It is reported that the ternational & Great Northern R. R. has plans prepared and will submit them to City Council for the 2-story and basem stone and brick office building and 1-st brick and steel, 494x50 ft., freight wareho which they intend erecting in this city. D. Trammel, Ch. Engr., Palestine.

Kenosha, Wis.—Plans are being prepa for an addition to the Y. M. C. A. build which will cost about $15,000.

Carberry, Man.—Bids will be received 15 by T. D. Stickle, at Carberry, for erec a 3-story brick block, 75x80 ft., on Main John Woodman, Archt., Merchants Bank Winnipeg.

NEW YORK, N. Y.

38 W. 20th St., 6-story br and stone bldg; c, $38,000; o, Lewis A. Mitchell; Adolph Mertin.

41 W. 21st St., 7-story br and stone s and loft bldg; c, $50,000; o, The Boto Co.; a, Hartwell & Hartwell.

21st St. and Fourth Ave.; 5-story br stone store and loft bldg; c, $20,000; o, tate of Elizabeth S. Peckham; a, Wm. Hume & Son.

126 W. 42d St., 6-story br and stone s and loft bldg; c, $75,000; o, C. C. Shayne Albert S. Gottlieb.

2 E. 44th St., 5-story br and stone

**Items marked thus give the names of parties awarded contracts.*

; c, $100,000; o, Chas. F. Wetzel; a, & Stout.
4 W. 46th St., 6-story br and stone loft ; c, $25,000; o, Christian Wollerson; a, H. Knubel.
6th St. and Lenox Ave., three 6-story br stone stores and tenemts; total c, $135,- ; o, Markransky & Applebaum; a, Geo. elham.
550 Third Ave., 7-story br and stone ex- ion to two 5-story br and stone stores loft bldgs; c, $20,000; o, Greenwald ; a, Wm. B. Tuthill.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—The First Christian Society, reported, intends erecting a $15,000 edi- at Government and Dearborn Sts. Claude Hill, Pastor.

Colorado Springs, Colo.—C. A. Baldwin, 0 N. Cascade Ave., it is reported, has pur- ased the Hutton Pl., at Broadmoor, and erect a residence at a cost of about ,000.

Chicago, Ill.—Henry J. Schlacks, 109 Ran- ph St., has completed plans for a parochial ool and alterations to the church of St. ome's R. C. parish in Rogers Park. The ool will be a 1-story structure, 80x125 ft., h foundations strong enough to carry two ditional stories, and the church is to be ved and provided with new foundations. e total cost will be about $60,000.
Plans for the church to be erected for the w R. C. parish (Polish), organized by Arch- hop Quigley, are now being prepared. It ll be of brick and stone, 80x150 ft., with 2 wers, each 220 ft. high. The building is to erected at 18th St. and Union Ave., and e cost is estimated at $130,000.
Edwin H. Abbott will build two 3-story flat ildings, 50x63 ft., on Kenmore Ave., near nslie St., to cost $40,000.

Sunman, Ind.—Bids will be received Feb. by the St. John's Luthern Church, for ecting an edifice here. John F. Coes, Pres.

**Davenport, Ia.*—The contract to erect an partment building for P. Walsh, at 4th and ipley Sts., it is reported, has been awarded G. A. Hanssen, Archt., 54 Schmidt Bldg., Phillips & Volquardsen, 1412 W. 3d St., at bout $53,550. This contract does not in- ude plumbing, heating, electric wiring or as fixtures, all of which will be let under eparate contract.

Waterloo, Ia.—It is reported that the con- regation of the Christian Church has decided erect a new edifice at W. 4th and South ts., at a cost of $15,000.

Chickasha, Ind. Ter.—The members of the I. E. Church, it is reported, intend erecting n edifice at a cost of about $15,000.

Morristown, N. J.—It is reported that the ummer home of Otto H. Kahn, near here, hich was recently destroyed by fire, is to e rebuilt.

Anglesea, N. J.—John Windrim, of Phila- delphia, Pa., it is reported, has prepared lans for a $30,000 cottage to be erected on ennsylvania Ave. for V. E. Archambault, Jr., f Philadelphia.

Steubenville, O.—Plans have been prepared or a stone edifice to be erected by the con- regation of St. Peter's Church, at a cost of 100,000. Rev. Father Thos. A. Powers, ector.

Portsmouth, O.—The Trus. of the Holy edeemer Catholic Church of Portsmouth are tated to have decided to ask architects to ubmit plans for a new edifice to cost about 75,000, on or about March 1. Rev. J. E. McGuirk, Pastor, and Geo. E. Kricker, Secy. Bd. of Trus.

Bucyrus, O.—The Bldg. Com. of the Pres- byterian Church, it is stated, is contemplat- ing the erection of a new edifice, and have $18,000 available. Duncan Robertson, Chmn.

East Palestine, O.—Plans and specifica- tions, it is stated, have been submitted to the Bldg. Com. of the Methodist Episcopal Church for the proposed new church, which is to be erected this summer at an estimated cost of $30,000. Address Pastor.

Cincinnati, O.—Jos. G. Steinkamp, 24 E. Court St., is preparing plans for two apart- ment houses of stone and brick; one to be erected on Middleton Ave., to cost $23,000, the other on Burnet Ave., to cost $25,000.

Pittsburg, Pa.—J. J. Flannery, owner of the Iroquois apartment house on Fobes St., Oakland, it is reported, intends erecting a power house for the apartment, the cost to be about $25,000.

Pittsburg, Pa.—W. H. Sims, 6228 Bond St., it is stated, has prepared plans for a residence which is to be erected in Squirrel Hill district at a cost of $40,000.

Appleton, Wis.—It is reported that the Trus. of the Grace Episcopal Church have de- cided to erect a new stone edifice at once to cost about $25,000. Rev. S. P. Delany, Rector.

Milwaukee, Wis.—Leiser & Holst, Germania Bldg., it is reported, are preparing plans for a 4-story flat, which is to be erected by John Hunholz at State and 20th Sts., at a cost of $32,000.
Louis Auer, it is reported, has announced that he will erect 2 apartment houses, one at 15th and Prairie Sts., and the other at 14th and Prairie Sts., each to cost about $25,000, and to be 4 stories high.

La Crosse, Wis.—H. R. Wilson, of Chicago, Ill., it is reported, has prepared plans for a residence which is to be erected for Henry Gund at a cost of $40,000.

NEW YORK, N. Y.

113th St. and 2d Ave., 6-story br and stone tenemt; c, $50,000; o, B. Pernetti; a, Lorenz F. J. Weiher.
West End Ave. and 82d St., 6-story br and stone tenemt; c, $110,000; o, Willet Realty Co.; a, Elliott, Lynch & Orchard.
136th St. and Lenox Ave., four 6-story br and stone tenemts; total c, $152,000; o, M. & S. Grossman; a, Geo. F. Pelham.
133d St. and Amsterdam Ave., 6-story br and stone tenemts; c, $55,000; o, Landin & Stamm; a, Geo. F. Pelham.
151st and 152d Sts. and Broadway, six 5-story br and stone tenemts; total c, $270,- 000; o, Silverson & Shoff; a, Geo. F. Pelham.
St. Nicholas Ave. and 153d St., 6-story br and stone tenemt; c, $90,000; o, Marion Mil- ler; a, Wm. E. Young.
Bathgate Ave. and 175th St., two 5-story br tenemts; total c, $70,000; o, Louis E. Kleban; a, Maximilan Zipkes.
Beech Ave. and Kelby St., four 5-story br tenemts; total c, $180,000; o, Union Ave. Realty Co.; a, Geo. F. Pelham.
97th St. and Amsterdam Ave., 4-story br and stone tenemt; c, $110,000; o, Holy Name Parish; a, Elliott, Lynch & Orchard.

SCHOOLS.

Notes Arranged Alphabetically by States.

**El Dorado, Ark.*—J. F. Hanson, of Camden, Ark., it is reported, has received the contract to erect a school here at a cost of about $25,000.

Pasadena, Cal.—W. J. Bleisner, of Los An- geles, it is stated, has prepared plans for a school to be erected here at a cost of $21,000.

Washington, D. C.—Local press reports state that Hornblower & Marshall, of Wash- ington, D. C.; Delano & Aldrich, Hale & Morse, Geo. B. Post and Wm. A. Boring, all of New York City, and Parker & Thomas, of Boston, Mass., and Baltimore, Md., have been requested to submit plans by March 15 to Prof. Percy Ash, for the group of buildings which are to be erected for the Geo. Wash- ington Univ. at Van Ness Park. There are 13 buildings in the group, including an adminis- tration building, cost $500,000; an alumni hall, $150,000; a hall for law politics and diplomacy, $150,000; a hall for class rooms and professors' offices to be known as Cor- coran Hall, $125,000; a hall for the school of architecture, $60,000; 8 dormitories, to be separate or in block, $150,000. The costs are only approximate, but are to include every- thing but paintings and furniture.

Chicago, Ill.—See "Churches and Dwell- ings."

Freeport, Ill.—It is reported that bids will be received until March 10 for erecting a school to cost about $30,000.

Lincoln, Ill.—The St. Mary's R. C. Church, it is reported, will erect a school to cost $20,- 000. Rev. C. Riedel, Pastor.

Indianapolis, Ind.—The School Bd. has de- cided to erect a school in Haughville, at a probable cost of $75,000.

South McAlester, Ind. Ter.—It is reported that school bonds amounting to about $150,- 000 are about to be issued.

**Geneva, Ia.*—E. Whitney, of Humboldt, it is reported, has received the contract to erect a school here to cost about $25,000.

**Iowa City, Ia.*—The contract to move the Science Hall at the Iowa State Univ., it is reported, has been awarded to Kluger Bros., of Chicago, Ill., at about $15,400.
G. H. Ellsworth, Supt. Grounds & Bldgs. State Univ. of Iowa, writes that no date has yet been set for the opening of bids for the erection of the first section of the Engineer- ing Building at the university.

Ames, Ia.—See "Power Plants, Gas and Electricity."

Goldfield, Ia.—It is stated that plans have been prepared for a $17,000 8-room school.

West Des Moines, Ia.—Bids will be re- ceived March 4 by H. U. Keasey, Secy. The Independent School Dist., 504 Good Blk., Des Moines, for erecting fire escapes on schools, and for smoke consumers for West High School of said school dist.

Covington, Ky.—The Bldg. Com. has been authorized by the Bd. of Educ. to have plans prepared and bids asked for the erection of a fireproof school in the 6th Dist., the cost to be about $72,000.

Baton Rouge, La.—The Bldg. Com. has ap- proved the plans of L. S. Weathersby, of Memphis, Tenn., for the 2-story and basement stone and brick school, which is to be erected at a cost of $25,000.

Fairfield, Me.—It is reported that E. J. Lawrence intends erecting a high school here.

Baltimore, Md.—The Bldg. Com. of the Maryland Institute, it is reported, is receiv- ing competitive plans until March 15 for the new Maryland Institute, which is to be a 3-story structure, 140x115 ft. Probable cost, $250,000.

Chestertown, Md.—The Bd. of Visitors & Governors of the Washington College, it is stated, has decided to erect a new admin- istration building on the campus, to be a 4- story brick structure, and to cost $25,000.

Boston, Mass.—Plans have been filed by Archt. Wm. H. McGinty, 101 Tremont St., for a 9-room primary school, to be located on Howard Ave., Ward 16. It will be 105x41 ft., brick and terra cotta; first class construc- tion; 3 stories and basement. Bids will be soon called for.

Lowell, Mass.—John J. O'Connor, of the Lands & Bldg. Dept., has been instructed by the Com. on Educ. to receive plans for the school which is to be erected in Centralville at a cost of between $50,000 and $75,000.

Grand Rapids, Mich.—The Bd. of Educ. has adopted the plans for the school improve- ments, which include the erection of a $75,- 000 annex to the Central High School, and additions to Union St. School to cost $15,000, and Henry St. School to cost $12,000.

Hattiesburg, Miss.—It is reported that $16,000 school bonds are about to be issued.

Hanover, N. H.—The sum of $170,000 has been subscribed for the rebuilding of the old Dartmouth hall, at Dartmouth College, and the work will commence in the spring.

Kearny, N. J.—The School Trus., it is re- ported, have decided to receive bids until March 14 for erecting a 4-room addition to School No. 5, and an 8-room addition to School No. 4.

**New York, N. Y.*—Fanning & Reilly, 150 Fifth Ave., have secured the contract for the general construction of School No. 42, Bronx Boro. (bids opened Jan. 30) for $221,660.
*The following are the bids opened on Feb. 6, by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for additions and alter- ations to (*a*) School No. 10, Manhattan Boro.; (*b*) School No. 10, Bronx Boro.: Waters & O'Connell, *a*, $97,539; Peter J. Ryan, 314 W. 44th St., *a*, $91,739 (awarded contract); Patk. Sullivan, 309 Broome St., *a*, $106,400; *b*, $92,640 (awarded contract). P. Gallagher, *a*, $103,000; Tolmie & Kerr, *a*, $102,687; Jos. Ohlhausen, *a*, $96,340; Wm. Werner, *a*, $101,- 937; *b*, $96,786. Fanning & Reilly, *a*, $100,- 786; Chas. H. Peckworth, *a*, $99,970; *b*, $97,- 231. Hartman & Horgan, *a*, $102,700; *b*, $99,333. P. J. Brennan, *a*, $103,000; *b*, $105,000.. Thos. Cockerill & Son, *a*, $98,900; *b*, $104,500. Guidone & Galardi, *a*, $91,900; *b*, $96,900. Thos. McKeown, *a*, $97,347; Wm. H. Wright & Son, *b*, $104,575; Geo. Hilde- brand, *b*, $97,400; Louis Wechsler, *b*, $101,- 750; Lincoln & Ranney, *b*, $105,800.
*Bids were opened same time and place for ventilating and heating addition to and alterations in School No. 104, Manhattan Boro.: Jas. Curran Mfg. Co., 512 W. 36th St., $16,869 (awarded contract); Evans, Almirall & Co., $21,185; Geo. A. Suter, $21,- 374; Blake & Williams, $23,135; Rossman & Bracken Co., $21,000; E. Rutzler Co., $19,- 665; Frank Dobson, $19,060; John Hankin & Bro., $22,487.

**Brooklyn, N. Y.*—The following are the bids opened on Feb. 6, by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for the gen- eral construction of addition to and alter- ations in School No. 109, Brooklyn Boro.: John Auer & Sons, $313,780; Clarke & Stowe, $317,200; Thos. Cockerill & Son, $344,900; Chas. H. Peckworth, $319,728; Wm. P. McGarry, 236 Huron St., $292,298 (awarded contract); Geo. Hildebrand, $314,400; Juan B. Arci, $318,000, and Richard E. Hening- ham, $312,763. Jas. Harley & Co., 288 Flat- bush Ave., secured the contract for plumbing same at $3,918.
*Chris. Nally, 2398 B'way, N. Y. City, has secured the contract for sanitary work and gas fitting of addition to and alterations in School No. 110, Brooklyn Boro. (bids opened Jan. 30) for $9,551.

Long Island City, L. I., N. Y.—Bids will be received Feb. 20 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for erecting School No. 87, Boro. Queens.

Troy, N. Y.—Palmer C. Ricketts, Pres. of the Rensselaer Polytechnic Institute, has an- nounced that Andrew Carnegie has given the Institute $125,000 to rebuild the main build- ing, which was destroyed by fire last June.

Souris, N. D.—It is reported that bids will be received until Feb. 24 for erecting a high school in Dist. No. 20. J. Homer, Clk. Bd. Educ.

Jamestown, N. D.—Reports state that a school is to be erected here at a cost of $25,000.

Jewett, O.—It is stated that bids will be received Feb. 17 by Chas. S. Beetham, Clk. Bd. Educ., for erecting an 8-room brick school with stone trimmings. Chas. Henry & Sons, Archts., Akron.

Cleveland, O.—C. W. Hopkinson, 900 Rose Ave., is the archt. for the Rockefeller labora- tory of metallurgy and mining engineering, which is to be erected in the spring at the Case School of Applied Science, and is to be of brick and stone, 2 story and basement, 140x70 ft.

Pittsburg, Pa.—The Finance Com. has recommended the appropriating of $2,260,573 for sundry purposes, including $205,000 for the Central Bd. of Educ.
Andrew Carnegie has approved the plans for the first building of the Carnegie Techni- cal School.

**Philadelphia, Pa.*—Lynch Bros., it is re- ported, has received the contract to erect a school on Race and 6th Sts. (bids opened Feb. 7, at $53,492.
Other bids received on Feb. 7 for erecting 3 schools, one each at 38th and Powelton Sts., Rhawn and Ditman Sts., and 22d and Brown Sts., were all above the money avail- able, and are held under consideration.

Aspinwall, Pa.—It is reported that bids will be received until Feb. 17 for erecting a 3-story addition to public school. H. A. Stout, Secy. Bd. Educ.

Shamokin, Pa.—Bids will be received Feb. 21 by the School Dirs. for furnishing ma- terials and erecting two 15-room schools to be known as Grant and Steven's School. John Harris, Secy. School Bd.

Conway, S. C.—Bids will be received March 1 by C. P. Quattlebaum, Chmn. Bldg. Com., for erecting a 2-story brick school. H. E. Bonitz, Archt., Wilmington.

Clifton, Tenn.—It is stated that the citi- zens have voted in favor of erecting a college here at a cost of $10,000.

Chattanooga, Tenn.—The House has passed a bill authorizing the issue of bonds amount- ing to $125,000 for school buildings and grounds.

Buckhannon, W. Va.—The main building at the Wesleyan Univ., it is reported, has been destroyed by fire.

**Green Bay, Wis.*—Shine & Shug, of Green Bay, it is stated, have received the contract for the heating of St. Patrick's School, at $2,050, and The Sanitary Supply Co. the con- tract for the plumbing, at $1,364.

Wauwatosa, Wis.—The Common Council has accepted the plans of Leenhouts & Guth- rie, 102 Wisconsin St., Milwaukee, for the high school to be erected at a cost of $24,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Meriden, Conn.—Angelo Carrozello, of Meri den, is stated to have secured the contract for collecting the city garbage for one year, beginning Mar. 1, for $4,400.

**Elmira, N. Y.*—The Clinton Foundry & Machine Co., 59 Liberty St., N. Y. City, on Feb. 1, secured the contract for constructing a garbage crematory, bids for which were opened by City Council Aug. 26, for $16,277. Fred. Leach, City Engr.

New York, N. Y.—Plans have been filed for a 1-story brick and stone rubbish incinerator to be erected at Delancey and Tompkins Sts. for the Street Cleaning Dept. of New York City, at a cost of $27,000. H. & B. Parsons, Archts., 22 William St. Advertised in The Engineering Record.

**Ft. Sam Houston, Tex.*—L. J. Fleming, Constr. Q. M., U. S. A., writes that the con- tract for a garbage crematory, to consume ¾ of a ton per hour or 6 tons in 8 hours, with building to inclose same, has been awarded to Lewis & Kitchen, of Kansas City, Mo., for $4,925 (bids opened Jan. 5).

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

The Archbold-Brady Co., 1016 E. Water St., Syracuse, N. Y., intends to put up a build- ing, about 90x130 ft., for fabricating struc- tural steel and similar work. The power plant will probably consist of alternating- current motors direct-connected to the ma- chinery.

The Haughton Elevator & Machine Co., To- ledo, O., will remodel and improve its plant The company will also buy some new ma- chinery and tools for its shops, but has not yet decided just what it wants.

The Smith Mining & Improvement Co., Fa- yetteville, Ark., has been organized for de- veloping mineral lands of H. E. Smith, near Chester, Ark. The company wants ore-pul- verizing machinery.

The Rubber Paint Co., Chicago, Ill., has not fully decided the capacity of the power plant to be installed in its new plant.

For ice plant at Graham, N. C., see "Power Plants, Gas and Electricity."

The Harlan & Hollingsworth Co., Wilmng- ton, Del., is about to build a 300x125-ft. boiler shop.

The I. X. L. & Goshen Pump Co., Goshen, Ind., contemplates building a 2-story and basement, 40x110-ft. addition to its finishing room, a 2-story, 40x60-ft. addition to its ma- chine room and installing an electric light plant.

The New Departure Mfg. Co., Bristol, Conn., has decided to install a power plant of about 700 h.p. capacity, but details have not yet been decided. Frank Slater, New Britain, Conn., consulting engineer.

The Hanover, Ont., Portland Cement Co., Ltd., is considering the advisability of in- stalling rotary kilns next fall.

The Cullowhee, N. C., Copper Co., which has a capital of $100,000, contemplates erect- ing a smelting plant, but plans have not yet been fully developed. Thos. A. Cox, secy. and supt.

The Brantley Mfg. Co., First National Bank Bldg., Birmingham, Ala., is erecting a new plant, the main building of which will be 100x125 ft., and is in the market for shafting.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

**Red Fork, Ark.*—A. Wynn, of Eureka Springs, Pres. Red Fork Levee Bd., writes that the following are the bids opened on Feb. 1 for 50,000 cu. yds. levee work near Red Fork (price given per cu. yd.): Roach & Stan- sill, Memphis, Tenn., 14.94 cts.; Lacy Bros., Arkansas City, Ark., 14.4 cts. (awarded con- tract); S. McCadden, Memphis, Tenn., 15.45 cts., and Hughey McCartin, Memphis, Tenn., 14.4 cts.

**Items marked thus give the names of parties awarded contracts.*

Roosevelt, Ariz.—Bids will be received at the office of the U. S. Reclamation Service, Phoenix, on Feb. 23 (extension of date from Feb. 8) for the construction of the Roosevelt dam and two bridges on Salt River, as advertised in The Engineering Record.

San Francisco, Cal.—Bids will be received by the California Debris Comn. March 3 for furnishing and delivering cement for building portion of dam known as Barrier No. 1, Yuba River, Cal., as advertised in The Engineering Record.

New London, Conn.—Bids will be received by Lieut.-Col. Chas. F. Powell, Corps Engrs., U. S. A., on Feb. 21, for furnishing 332,000 hard building brick, as advertised in The Engineering Record.

Washington, D. C.—See "Power Plant, Gas and Electricity."

Washington, D. C.—Bids will be received Feb. 28 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of sheet brass and copper, wrought iron, seamless drawn brass pipe, brass and galvanized iron pipe fittings, valves, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

**Savannah, Ga.*—Lieut.-Col. Jas. B. Quinn, Corps Engrs. U. S. A., writes that the following are the bids opened on Feb. 3 for dredging (*a*) Darien Harbor, 85,000 cu. yds.; (*b*) Doboy Harbor, 110,000 cu. yds. (price given per cu. yd.): Daniel J. Leary, Brooklyn, N. Y., *a*, 18 cts.; *b*, 38 cts. P. Sanford Ross, Inc., Jersey City, N. J., *a*, 11.85 cts. (recommended for award). Rittenhouse Moore, Mobile, Ala., *a*, 25 cts.; *b*, 35 cts. Bids for dredging on Doboy Bar recommended for rejection as excessive. This work will probably be done by U. S. Seagoing Suction Dredge.

**Chicago, Ill.*—The Jeffreys Mfg. Co., of Columbus, O., has secured the contract for the mail conveying system for the U. S. Post Office (bids opened Jan. 4) for $53,895.

Des Moines, Ia.—The City Council is stated to have authorized City Engr. Budd to proceed with plans for the improvement of Des Moines and Raccoon River bottoms. The improvements will cost about $350,000. The people will probably vote upon the proposition during the coming spring.

Baltimore, Md.—Bids will be received Feb. 15 by the Bd. of Awards for furnishing and delivering 310 ft. double-strength 36-in. vitrified clay pipe, 7,800 lin. ft. wrought iron black pipe, etc. W. W. Crosby, Gen. Supt. Bd. Park Comrs.

Boston, Mass.—Bids will be received until March 6 by Col. W. S. Stanton, Corps. Engrs., U. S. A., Boston, for removing wrecks of canal boats "Russell Wright" and "Anna Weightman" off Port Henry, N. Y., and "Julius Fulton, Jr.," at Rouse's Point, N. Y., all in Lake Champlain.

Newark, N. J.—The Essex County Park Comn. is stated to have voted to ask the Bd. of Freeholders to sell $500,000 park bonds, the money to be expended for the acquirement of land, to be added to the South Mountain Reservation, and the development of plans of improvement already begun in other parks and reservations.

**New York, N. Y.*—The following are the bids opened on Feb. 1 and 2 by the Dept. of Docks & Ferries for building 4 piers: (*a*) E. 108th St.; (*b*) E. 102d St.; (*c*) E 109th St.; (*d*) E. 37th St.; (*e*) 8,160 cu. yd. rip rap for E. 37th St. pier (per cu. yd.): Snare & Triest Co., 39 Cortlandt St., *a*, 21,860; *b*, 18,946; *c*, 21,690; *d*, 18,310; *e*, 50 cts. Bernard Rolf, 39 Cortlandt St., *a*, 22,233; *b*, 17,433 (awarded contract); *d*, 18,433; *e*, 45 cts. G. B. Spearin, 17 Battery Pl., *a*, 22,231; *b*, 19,332; *c*, 20,989; *d*, 18,621; *e*, 45 cts. Wm. H. Jenks, 129 Pearl St., *a*, 24,500; *b*, 24,000; *c*, 21,999; *d*, 19,999; *e*, 50 cts. J. M. Briggs, 17 Battery Pl., *a*, 22,890. R. P. & J. H. Staats, 29 Broadway, *a*, 22,125; *b*, 18,850; *c*, 22,120. Aug. Walsh, 96 Water St., *a*, 22,993; *b*, 18,474; *d*, 18,400; *e*, 45 cts. N. Y. State Construction Co., 70 Broad St., *a*, 21,193 (awarded contract); *b*, 17,957; *c*, 20,911 (awarded contract); *d*, 16,519 (awarded contract); *e*, 45 cts. (awarded contract).

Bids will be received Feb. 21 by Maurice Featherson, Comr. of Docks, for furnishing, delivering and placing about 15,000 cu. yds. cobble, and about 20,000 cu. yds. rip rap stone.

Bids will be received until Feb. 21 by the Dept. of Docks & Ferries for furnishing the material and extending and repairing pier at 35th St., East River. Maurice Featherson, Comr.

**Albany, N. Y.*—Lindon W. Bates, 74 B'way, has secured two of the contracts for the New York State Canal Improvement, as follows: For Contract No. 1—Champlain Canal River Line—(bids opened Dec. 15) for $605,008, and Contract No. 4, Erie Canal Sect. 5 (bids opened Dec. 16) for $726,815. For list of detailed bids received for this work, see issue of The Engineering Record, Dec. 24. N. V. V. Franchot, State Supt. Pub. Wks.

New York, N. Y.—See "Electric Railways."

Buffalo, N. Y.—The Assembly at Albany has passed the bill to bond the City of Buffalo for $150,000 to abate the Hamburg Canal nuisance.

Bids will be received until Feb. 14 by the Bd. of Superv. (Alonzo G. Hinkley, Clk.) for furnishing material and labor for supply branches, soil and waste pipes and drain connections for the new armory for the 65th Regt., N. G. S. N. Y.

Dayton, O.—The City Council has passed a resolution authorizing the preparation of plans and estimates for the repairing or rebuilding of Steel's dam. F. M. Turner, City Engr.

Cleveland, O.—Bids will be received Feb. 17 by the Bd. Pub. Service for dredging a portion of Cuyahoga River outside of new dock, bet. Voltaire and Columbus Sts., work to include removing of timber, logs, piles and other material, and placing said material within protection work known as Lake Front Improv. A. R. Callow, Secy.

Bids will be received Feb. 21 by the Bd. Pub. Service for dredging and removing bars and other obstructions from Cuyahoga River, Old River Bed and Sycamore St. slip, from April 1, 1905, to Dec. 31, 1905. A. R. Callow, Secy.

Philadelphia, Pa.—The following are the bids opened on Feb. 4 by the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for improvement to the 100-ton shears at the Navy Yard, League Island, Pa.; (*a*) for placing the shears and all appurtenances in efficient working order, complete; (*b*) amount to be added if a new hoisting rope of 1-in. diam. is supplied: Snare & Triest Co., 39 Cortlandt St., New York, N. Y., *a*, $15,900; *b*, $450. The Scofield Co., Pennsylvania Bldg., Philadelphia, Pa., *a*, $20,070; *b*, $250. R. G. Packard Co., 130 Pearl St., New York, N. Y., *a*, $15,744; *b*, $200.

Nashville, Tenn.—The following are the bids opened on Feb. 4 by the Superv. Archt. Treas. Dept., Washington, D. C., for the installation of an electric passenger elevator in the U. S. Custom House and Post Office at Nashville: Otis Elevator Co., New York, N. Y., $6,585; Marine Engine & Machine Co., New York, N. Y., $6,052.

**Panama.*—Contracts have been awarded by the Isthmian Canal Comn. as follows: To Brown & Co. of New York, N. Y., for hewn cross cypress ties, at $72,500, and for switch cypress ties, $5,450; to the American Mercantile Co. of Tacoma, Wash., for piles, $20,000, and to the Pascagoula Creosoting Works of West Pascagoula, Miss., for $38,125.

Panama.—Bids will be received Feb. 28 by the Isthmian Canal Comn., Washington, D. C. (J. G. Walker, Chmn.), for furnishing rock drills.

Bids will be received Feb. 28 by the Isthmian Canal Comn., Washington, D. C. (J. G. Walker, Chmn.), for furnishing 5 contractors' wagons.

Collingwood, Ont.—Bids will be received Feb. 17 by Fred. Gelinas, Secy. Dept. Pub. Wks., Ottawa, for constructing a wharf here.

PROPOSALS OPEN.

For proposals see pages 26, 27, 28, 29 and 30.

Bids Close.	WATER WORKS.	See Eng. Record.
Feb. 13.	Boiler, Asbury Park, N. J. Adv. Jan. 28, Feb. 4.	Jan. 28
Feb. 14.	Pipe, etc., Syracuse, N. Y.	Feb. 11
Feb. 18.	Pipe, Seattle, Wash.	Feb. 11
Feb. 18.	Boilers, etc., Norwood, O.	Jan. 28
Feb. 20.	Pumping Station, East Toronto, Ont.	Feb. 11
Feb. 20.	Specials, Washington, D. C. Adv. Feb. 4.	Feb. 4
Feb. 22.	Schoharie, N. Y. Adv. Jan. 28, Feb. 4.	Jan. 28
Feb. 23.	Machinery, pipe, etc., Menasha, Wis., Adv. Feb. 11.	Feb. 11
Feb. 23.	Mains, Ft. Preble, Me.	Feb. 4
Feb. 23.	Tillamook Ore.	Jan. 14
Feb. 24.	Meters, Cleveland, O. Adv. Feb. 11.	Feb. 11
Mar. 1.	Graham, N. C.	Feb. 11
Mar. 1.	Charton, Ia.	Jan. 28
Mar. 3	Tank, etc., Ft. Reno, Okla. Ter.	Feb. 11
Mar. 4.	Meeker, Colo.	Feb. 4
Mar. 6.	Pumping plant, Iowa Falls, Ia.	Feb. 11
Mar. 8.	Mains, Ft. DuPont, Del. Adv. Feb. 11.	Feb. 11
Mar. 8.	Filtration, Pittsburg, Pa. Adv. Jan. 28 to Feb. 11.	Jan. 28
Mar. 21.	Well, Ft. Caswell, N. C. Adv. Feb. 4, 11.	Feb. 4
Mar. 31.	Meters, Pocatello, Idaho. Adv. Jan. 28 to Feb. 11.	Jan. 28
Mar. —.	Smith's Grove, Ky.	Jan. 7
Apr. 1.	Irrig., Usk, Wash.	Dec. 24
May 1.	Shirley, Ind.	Feb. 11

	SEWERAGE AND SEWAGE DISPOSAL.	
Feb. 14.	Cleveland, O.	Feb. 4
Feb. 14.	St. Louis, Mo.	Feb. 4
Feb. 14.	Bogota, N. J.	Jan. 28
Feb. 15.	New York, N. Y.	Feb. 11
Feb. 15.	Havana, Ill. Adv. Jan. 14 to Feb. 11.	Jan. 14
Feb. 15.	Marion, O.	Feb. 4
Feb. 15.	Linenburg, N. S.	Jan. 14
Feb. 16.	Sullivan, Ind.	Feb. 4
Feb. 16.	St. Bernard, O.	Jan. 21
Feb. 17.	Mamaroneck, N. Y.	Feb. 4
Feb. 18.	Seattle, Wash.	Feb. 11
Feb. 21.	Coldwater, Mich.	Feb. 11
Feb. 23.	New York, N. Y.	Feb. 11
Feb. 23.	New Rochelle, N. Y.	Jan. 28
Feb. 24.	Wilkesbarre, Pa. Adv. Feb. 4, 11.	Feb. 4
Mar. 6.	Washington, D. C. Adv. Feb. 11.	Feb. 11

	BRIDGES.	
Feb. 14.	Madison, Neb.	Feb. 4
Feb. 14.	Napa, Cal.	Dec. 31
Feb. 15.	Piqua, O.	Feb. 11
Feb. 15.	Saginaw, Mich.	Feb. 4
Feb. 16.	Des Moines, Ia.	Feb. 11
Feb. 16.	Columbus, O.	Jan. 21
Feb. 16.	Charleston, W. Va. Adv. Jan. 21.	Jan. 21
Feb. 17.	Port Clinton, O.	Jan. 21
Feb. 18.	Cincinnati, O.	Jan. 28
Feb. 20.	Culpepper, Va. Adv. Jan. 28.	Jan. 28
Feb. 20.	York, Neb.	Jan. 28
Feb. 21.	Celina, O.	Feb. 4
Feb. 21.	Kearney, Neb.	Feb. 4
Feb. 22.	Buffalo, N. Y.	Feb. 11
Feb. 23.	Dover, Ont.	Feb. 4
Mar. 1.	South Bend, Ind.	Jan. 28
Mar. 4.	Valley City, N. D.	Feb. 11
Mar. 6.	Amite City, La.	Feb. 11
Mar. 6.	San Jose, Cal.	Feb. 4
Mar. 13.	San Bernardino, Cal.	Feb. 11
Apr. 4.	Goldendale, Wash.	Feb. 11

	PAVING AND ROADMAKING.	
Feb. 14.	Wildwood, N. J.	Feb. 11
Feb. 14.	Savannah, Ga.	Feb. 11
Feb. 15.	Hollidaysburg, Pa.	Feb. 11
Feb. 15.	New York, N. Y.	Feb. 11
Feb. 15.	Meadville, Pa.	Feb. 4
Feb. 15.	Toledo, O.	Feb. 4
Feb. 15.	Cornwall, Conn.	Jan. 28
Feb. 15.	Leesville, La.	Jan. 28
Feb. 15.	Madison, Wis.	Jan. 21
Feb. 16.	Des Moines, Ia.	Feb. 4
Feb. 18.	Seattle, Wash.	Feb. 11
Feb. 18.	Delaware, O.	Feb. 11
Feb. 18.	Washington, D. C. Adv. Jan. 21.	Jan. 21
Feb. 20.	Flint, Mich.	Feb. 4
Feb. 21.	Winnipeg, Man. Adv. Feb. 4, 11.	Feb. 4
Feb. 21.	Cleveland, O.	Feb. 11
Feb. 21.	New York, N. Y.	Feb. 4
Feb. 23.	Peru, Ind.	Feb. 11
Feb. 23.	Geneva, N. Y.	Feb. 11
Feb. 23.	Brooklyn, N. Y.	Feb. 11
Feb. 23.	Cincinnati, O.	Feb. 4
Feb. 24.	Carlisle, Pa.	Feb. 11
Feb. 24.	Cincinnati, O.	Feb. 4
Feb. 24.	York, Pa.	Feb. 4
Feb. 25.	Celina, O.	Feb. 4
Feb. 27.	Elyria, O.	Feb. 11
Feb. 27.	Wilkesbarre, Pa. Adv. Feb. 4, 11.	Feb. 4
Feb. 27.	Hartford, Conn. Adv. Jan. 28, Feb. 4.	Jan. 28
Mar. 1.	Grass Valley, Cal.	Jan. 28
Mar. 3.	Cincinnati, O.	Feb. 11
Mar. 7.	Broad Ripple, Ind.	Feb. 11

	POWER, GAS AND ELECTRICITY.	
Feb. 14.	St. Louis, Mo.	Feb. 4
Feb. 14.	New York, N. Y.	Feb. 4
Feb. 15.	Baltimore, Md.	Feb. 11
Feb. 15.	West Point, N. Y. Adv. Jan. 28 to Feb. 11.	Jan. 28
Feb. 15.	Governor's Island, N. Y.	Jan. 28
Feb. 15.	Cleveland, O.	Jan. 21
Feb. 15.	Temple, Tex.	Jan. 21
Feb. 15.	Chicago, Ill.	Dec. 24
Feb. 17.	Niagara Falls, Ont.	Feb. 11
Feb. 17.	Cleveland, O.	Feb. 11
Feb. 21.	Washington, D. C.	Feb. 11
Feb. 21.	New York, N. Y.	Feb. 11
Feb. 27.	Los Angeles, Cal.	Feb. 11
Mar. 1.	Graham, N. C.	Feb. 11
Mar. 3.	Savannah, Ga.	Feb. 11
Mar. 20.	Washington, D. C. Adv. Feb. 11.	Feb. 11
Apr. —.	Ft. Valley, Ga.	Jan. 21
May 1.	Shirley, Ind.	Feb. 11
———.	Laconia, N. H. Adv. Jan. 28.	Jan. 28

	BUILDINGS.	
Feb. 13.	Fire Engine House, Chicago, Ill.	Feb. 11
Feb. 13.	Htg., etc., Museums, Philadelphia, Pa.	Feb. 4
Feb. 13.	Post Bldgs., Point Bonita, Cal. Adv. Jan. 21 to Feb. 11.	Jan. 21
Feb. 13.	Court House, Carlton, Minn.	Jan. 21
Feb. 14.	School, New Brighton, S. I., N. Y.	Feb. 4
Feb. 14.	School, Brooklyn, N. Y.	Feb. 4
Feb. 14.	School, New York, N. Y.	Feb. 4
Feb. 14.	School, Orange, N. J.	Jan. 28
Feb. 14.	Armory, Binghamton, N. Y. Adv. Jan. 21 to Feb. 4.	Jan. 21
Feb. 14.	Htg. P. O. Bldg., Batesville, Ark., Adv. Jan. 14, 21.	Jan. 14
Feb. 15.	Fire Engine House, Newark, N. J.	Feb. 11
Feb. 15.	Office Bldg., Cedar Rapid, Ia.	Feb. 11
Feb. 15.	Bus. Bldg., Carberry, Man.	Feb. 11
Feb. 15.	Post Bldg., Ft. D. A. Russell, Wyo.	Feb. 11
Feb. 15.	Church, Sunman, Ind.	Feb. 11
Feb. 15.	Market House, Columbus, O.	Feb. 11
Feb. 15.	Pub. Bldg., Brooklyn, N. Y.	Feb. 4
Feb. 15.	School, Staunton, Va.	Jan. 28
Feb. 15.	Memorial Bldg., Cincinnati, O.	Jan. 28
Feb. 15.	Post Bldg., Ft. Wright, Wash.	Jan. 21
Feb. 15.	School, Talklai, Ariz.	Jan. 21
Feb. 15.	Church, Flandreau, S. D.	Jan. 21
Feb. 15.	Htg. P. O., Chillicothe, O.	Jan. 14
Feb. 16.	Pub. Bldg., Ft. Logan H. Roots, Ark.	Feb. 11
Feb. 16.	Post Bldgs., Ft. Harrison, Mont.	Feb. 4
Feb. 17.	School, Jewett, O.	Feb. 11
Feb. 17.	School, Aspinwall, Pa.	Feb. 11
Feb. 20.	School, Long Island City, L. I., N. Y.	Feb. 11
Feb. 20.	Hospital, Albany, N. Y.	Feb. 4
Feb. 21.	Life Saving Sta., Sandy Hook, N. J. Adv. Feb. 11.	Feb. 11
Feb. 21.	Municipal Court, New York, N. Y.	Feb. 11
Feb. 21.	Schools, Shamokin, Pa.	Feb. 11
Feb. 21.	Htg. Guard House, Ft. Assiniboine, Mont.	Jan. 28
Feb. 21.	Univ. Bldg., Washington, D. C.	Jan. 21
Feb. 21.	P. O. Bldg., Westchester, Pa. Adv. Dec. 31 to Jan. 7.	Dec. 31
Feb. 23.	Sashes, etc., War College, Washington, D. C., Adv. Jan. 28 to Feb. 11.	Jan. 21
Feb. 23.	Court House, Ellsworth, Wis.	Jan. 28
Feb. 23.	P. O. Bldg., Decatur, Ill. Adv. Jan. 14, 21.	Jan. 14
Feb. 24.	School, Souris, N. D.	Feb. 11
Feb. 25.	Htg. P. O. Bldg., Anniston, Ala.	Feb. 4
Feb. 27.	Post Bldg., Ft. Caswell, N. C. Adv. Feb. 4, 11.	Feb. 4
Feb. 27.	Post Bldg., Ft. Morgan, Ala. Adv. Feb. 4, 11.	Feb. 4
Feb. 27.	P. O. Bldg., Columbia, Mo.	Jan. 21
Feb. 28.	Office Bldg., Pineridge, S. D.	Feb. 11
Feb. 28.	School, Two Rivers, Wis.	Feb. 4
Feb. 28.	P. O. Bldg., Louisiana, Mo.	Jan. 21
Feb. —.	Hospital, Albany, N. Y.	Dec. 24
Mar. 1.	Church plans, Portsmouth, O.	Feb. 11
Mar. 1.	Court House, Lawrenceburg, Tenn.	Feb. 11
Mar. 1.	Htg. P. O. Bldg., Hastings, Neb., Adv. Feb. 4, 11.	Feb. 4
Mar. 1.	School, Conway, S. C.	Feb.
Mar. 1.	Court House, Edna, Tex.	Feb.
Mar. 1.	Htg., etc., Post Bldg., Chickamauga Park, Ga.	Feb.
Mar. 2.	P. O. Bldg., Adrian, Mich.	Jan.
Mar. 3.	Pub. Bldg., Washington, D. C.	Feb.
Mar. 4.	School, West Des Moines, Ia.	Feb.
Mar. 6.	Court House, Hot Springs, Ark.	Feb.
Mar. 6.	U. S. Soldiers' Home, Washington, D. C., Adv. Feb. 4, 11.	Feb.
Mar. 6.	Court House, Greenwood, Miss.	Jan.
Mar. 6.	P. O. Bldg., Battle Creek, Mich., Adv. Jan. 21, 28.	Jan.
Mar. 6.	Court House, Sardis, Miss.	Dec.
Mar. 7.	P. O. Bldg., Findlay, O. Adv. Jan. 21, 28.	Jan.
Mar. 8.	Stone work for Pub. Bldg., Washington, D. C., Adv. Feb. 11.	Feb.
Mar. 8.	P. O. Bldg., Muskegon, Mich.	Jan.
Mar. 9.	Post Bldg., Key West Barracks, Fla. Adv. Feb. 11.	Feb.
Mar. 9.	Court House, Elbow Lake, Minn.	Feb.
Mar. 9.	Htg. U. S. Hospital, Savannah, Ga.	Feb.
Mar. 10.	School, Freeport, Ill.	Feb.
Mar. 10.	Post Office, Ft. Rodman, Mass. Adv. Feb. 11.	Feb.
Mar. 10.	Post Bldgs., Ft. Ontario, N. Y. Adv. Feb. 11.	Feb.
Mar. 11.	Naval Prison, New York, N. Y.	Feb.
Mar. 13.	P. O. Bldg., Hammond, Ind. Adv. Jan. 28, Feb. 4.	Jan.
Mar. 14.	School, Kearny, N. J.	Feb.
Mar. 14.	P. O. Bldg., Moberly, Mo. Adv. Jan. 28, Feb. 4.	Jan.
Mar. 15.	Md. Instl. plans, Baltimore, Md.	Feb.
Mar. 15.	Univ. plans, Washington, D. C.	Feb.
Mar. 15.	Jail, Camden, N. J.	Feb.
Mar. 20.	P. O. Bldg., Elizabeth City, N. C., Adv. Feb. 4, 11.	Feb.
Mar. 21.	P. O. Bldg., Laredo, Tex. Adv. Feb. 4.	Feb.
Mar. 23.	P. O. Bldg., Sherman, Tex. Adv. Feb. 4, 11.	Feb.
Mar. 27.	P. O. Bldg., Lebanon, Pa. Adv. Feb. 11.	Feb.
Mar. 28.	P. O. Bldg, Superior, Wis.	Feb.
Mar. —.	School, Klamath Falls, Ore.	Jan.
Apr. 1.	Y. M. C. A. plans, Binghamton, N. Y.	Feb.
Apr. 5.	Court House plans, New Orleans, La.	Dec.
———.	School Bldg. material, etc., Phoenix, Ariz.	Feb.

	MISCELLANEOUS.	
Feb. 14.	Supply branches, etc., Buffalo, N. Y.	Feb.
Feb. 14.	Tunnel, Boston, Mass. Adv. Feb. 4, 11.	Feb.
Feb. 15.	El. Ry., Evansville, Ind.	Feb.
Feb. 15.	Pipe, etc., Baltimore, Md.	Feb.
Feb. 15.	Garb. Incinerator, New York, N. Y., Adv. Feb. 4, 11.	Feb.
Feb. 15.	Stone crusher, Panama	Feb.
Feb. 15.	Steam pump, Ft. McKinley Me. Adv. Jan. 21 and 28.	Jan.
Feb. 15.	Dredging, Chicago, Ill. Adv. Jan. 21 to Feb. 11.	Jan.
Feb. 16.	Wharf, San Francisco, Cal.	Jan.
Feb. 16.	Garbage, Chicago, Ill. Adv. Jan. 21 to Feb. 11.	Jan.
Feb. 16.	Dredging, Detroit, Mich. Adv. Jan. 14 to Feb. 11.	Jan.
Feb. 17.	Dredging, Cleveland, O.	Feb.
Feb. 17.	Wharf, Colingwood, Ont.	Feb.
Feb. 17.	Drainage, Ft. Andrews, Peddocks Island, Mass.	Jan.
Feb. 17.	Emb'kmt work, San Francisco, Cal. Adv. Jan. 28 to Feb. 11.	Jan.
Feb. 18.	Channel work, etc., New Orleans, La. Adv. Jan. 28 to Feb. 11.	Jan.
Feb. 18.	Crushed stone, Cincinnati, O.	Jan.
Feb. 18.	Drain Pipe, Cincinnati, O.	Jan.
Feb. 20.	Elevator, Green Castle, Ind.	Feb.
Feb. 20.	Garb. Disp., Waterbury, Conn.	Feb.
Feb. 21.	Pier, New York, N. Y.	Feb.
Feb. 21.	Brick, New London, Conn. Adv. Feb. 11.	Feb.
Feb. 21.	Rip Rap stone, etc., New York, N. Y.	Feb.
Feb. 21.	Supplies, Washington, D. C.	Feb.
Feb. 21.	Dredging, Cleveland, O.	Feb.
Feb. 21.	Machine tools, Washington, D. C.	Jan.
Feb. 21.	Cement, Fernbank, O. Adv. Jan. 21 to Feb. 11.	Jan.
Feb. 23.	Dam, etc., Roosevelt, Ariz. Adv. Feb. 11.	Feb.
Feb. 23.	Cement, etc., Newport, R. I. Adv. Jan. 28 to Feb. 11.	Jan.
Feb. 23.	El. Ry. franchise, San Diego, Cal.	Jan.
Feb. 25.	Dredging, Philadelphia, Pa.	Feb.
Feb. 25.	Garb. Disp., New York, N. Y.	Feb.
Feb. 25.	Lock work, Cincinnati, O. (2 prop.) Adv. Jan 28 to Feb. 11	Jan.
Feb. 27.	El. Ry. franchise, San Jose, Cal.	Feb.
Feb. 27.	El. Ry. franchise, Stockton, Cal.	Jan.
Feb. 28.	Contractors' Wagons, Panama.	Feb.
Feb. 28.	Supplies, Washington, D. C.	Feb.
Feb. 28.	Rock Drills, Panama	Feb.
Feb. 28.	Machine tools, Washington, D. C.	Feb.
Mar. 1.	Island, Ellis Island, N. Y. Adv. Feb. 4, 11.	Feb.
Mar. 3.	Cement, San Francisco, Cal. Adv. Feb. 11.	Feb.
Mar. 6.	R. R. tunnel, New York, N. Y.	Feb.
Mar. 6.	Drainage work, Nebraska City, Neb.	Jan.
Mar. 7.	Ditches, Storm Lake, Ia.	Feb.
Mar. 15.	Dam, etc., Los Angeles, Cal. Adv. Jan. 21 to Feb. 11.	Jan.
Mar. 17.	Dredge, etc., St. Louis, Mo. Adv. Jan. 21 to Feb. 4.	Jan.
Mar. 31.	El. Ry., Shanghai, China	Oct.
Apr. 10.	Channel work, Bermuda	Feb.
———.	El. Ry. franchise, Yazoo City, Miss.	Feb.

**Items marked thus give the names of parties awarded contracts.*